Department of Fish and Game

Massachusetts Marine Fisheries

2010 Annual Report

Department of Fish and Game

Massachusetts Division of Marine Fisheries

2010 Annual Report

Commonwealth of Massachusetts
Governor Deval Patrick

Executive Office of Energy and Environmental Affairs
Secretary Richard K. Sullivan, Jr.

Department of Fish and Game
Commissioner Mary B. Griffin

Division of Marine Fisheries
Director Paul J. Diodati

Daniel J. McKiernan
Deputy Director

David Pierce
Deputy Director

Kevin Creighton
Chief Financial Officer

www.mass.gov/marinefisheries

January 1 - December 31, 2010

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Introduction

The Massachusetts Division of Marine Fisheries (*MarineFisheries)* of the Department of Fish and Game is the Commonwealth's chief fisheries management agency. *MarineFisheries* is responsible for the development and promulgation of the Commonwealth's laws governing commercial and recreational fishing activity conducted in the marine environment. The Division promotes and develops commercial and recreational fisheries through research, technical assistance, and the collection of statistics. Guidelines for managing marine fisheries come through Chapter 130 of Massachusetts General Law, the Atlantic Coastal Fisheries Cooperative Management Act, the Interjurisdictional Fisheries Management Act, and the Magnuson-Stevens Fishery Conservation and Management Act.

To successfully fulfill its responsibilities, the Division has established the following mission, vision, and goals.

Mission

To manage the Commonwealth's living marine resources in balance with the environment resulting in sustainable fisheries and contributions to our economy, stable availability of diverse, healthy seafood and enriched opportunities that support our coastal culture.

Vision

Sustainable fisheries and a healthy marine ecosystem achieved through innovation, collaboration, and leadership enriching the public's way of life.

Goals

Improve fisheries sustainability, promote responsible harvest and optimize production of our living marine resources.

Promote and support our commercial and recreational fisheries.

Promote and support industry and community involvement in the fisheries management process.

Foster partnerships that help accomplish the Division's mission.

Support continued development of an ecologically sustainable marine aquaculture industry.

Promote a high level of staff commitment and professionalism.

Ensure that marine spatial planning activities are compatible with fisheries management.

Frequently Used Acronyms

ACCSP	Atlantic Coastal Cooperative Statistics Program
ACE	Annual Catch Entitlement
ACL	Annual Catch Limit
AM	Accountability Measure
ASMFC	Atlantic States Marine Fisheries Commission
CCB	Cape Cod Bay
CE	Conservation Engineering
DAS	Days-at-sea
EOEEA	Executive Office of Energy and Environmental Affairs
GIS	Geospatial Information System
ICCAT	International Commission on the Conservation of Atlantic Tunas
ISSC	Interstate Shellfish Sanitation Conference
LMA	Lobster Management Area
*Mass*DAR	Massachusetts Department of Agricultural Resources
*Mass*DCR	Massachusetts Department of Conservation and Recreation
*Mass*DEP	Massachusetts Department of Environmental Protection
*Mass*DOT	Massachusetts Department of Transportation
*Mass*DPH	Massachusetts Department of Public Health
MassGIS	Massachusetts Office of Geographic Information
MAFMC	Mid-Atlantic Fishery Management Council
MFAC	Marine Fisheries Advisory Commission
MRIP	Marine Recreational Information Program
NEFMC	New England Fishery Management Council
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NSSP	National Shellfish Sanitation Program
PCCS	Provincetown Center for Coastal Studies
PDT	Plan Development Team
PSP	Paralytic Shellfish Poisoning
SAFIS	Standard Atlantic Fisheries Information System
SMAST	School for Marine Science and Technology (at UMass Dartmouth)
SNE	Southern New England
TAC	Total Allowable Catch
USCG	United States Coast Guard
USFDA	United States Food and Drug Administration
USFWS	United States Fish and Wildlife Service
VTR	Vessel Trip Report
YOY	Young-of-year

FISHERIES MANAGEMENT AND POLICY SECTION

Policy and Fisheries Management Program

Personnel

Paul Diodati, Director
David Pierce, Deputy Director
Dan McKiernan, Deputy Director
Kevin Creighton, Chief Financial Officer
Kerry Allard, Program Coordinator II
Steve Correia, Senior Marine Fisheries Biologist
Dave Borden, Senior Fisheries Management Specialist
Melanie Griffin, Fisheries Management Specialist
Nichola Meserve, Fisheries Policy Analyst
Jared Silva, Program Coordinator
Shannon Davis, Program Coordinator

Overview

MarineFisheries is responsible for managing the Commonwealth's commercial and recreational fisheries. Management of marine resources unique to state waters and that cross state/federal marine boundaries is a constant, ongoing endeavor. A core of fisheries management professionals, with many years of practical experience and knowledge of Massachusetts recreational and commercial fisheries, composes the team that initiates, evaluates, and selects fisheries management policy and strategies to implement rules and regulations. These rules and regulations frequently result from participation on, and in support of, federal fisheries management through the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), and interstate fisheries management through the Atlantic States Marine Fisheries Commission (ASMFC).

Our fisheries policy and management staff gathers and analyzes biological and economic data, communicates with the media and public on state, interstate, and federal fisheries management issues, and ensures adherence to administrative and regulatory protocols and procedures. This process also relies on our technical staff to provide biological analyses and other technical reviews of management options to ensure sustainable fisheries and fisheries habitat protection.

Frequent communications with commercial and recreational fishery participants is another important element of policy and management development. This effort directly involves a diverse array of fishermen, dealers, processors, and many other stakeholders. Public hearings to propose regulation changes are held by the Commonwealth's Marine Fisheries Advisory Commission (MFAC) established by the Legislature in 1961. The MFAC and the Commissioner of the Department of Fish and Game must approve regulatory changes that *MarineFisheries* proposes in order for them to be implemented.

State Fisheries Management

Marine Fisheries Advisory Commission

The MFAC met nine times during 2010. At the March 11 MFAC Business Meeting, Mark Amorello was re-elected Chair, Vito Calomo was elected Vice-Chair, and Chuck Casella was re-elected Clerk.

MarineFisheries and the MFAC conducted six public hearings or comment periods in 2010 to implement the recreational saltwater fishing permit program and propose regulatory changes affecting fisheries for horseshoe crabs, aquaculture-reared shellfish, groundfish, spiny dogfish, northern shrimp, black sea bass, scup, summer flounder (fluke), coastal sharks, and weakfish. In addition, *MarineFisheries* held two public hearings for the ASMFC on the interstate management plans for American lobster and Atlantic striped bass.

Rulemaking changes of note in 2010 include:

- Revised regulations for the commercial harvest of horseshoe crabs (322 CMR 6.34) to promote conservation through spawning protection. Five-day spawning closures around new and full moons in May and June replaced the weekend closures. The trip limit for the summer period trawl fishery was liberalized from 400 pounds to 600 pounds to mitigate the effects of the spawning closures on the biomedical and horseshoe crab bait markets. A 7-inch minimum prosomal width was adopted to prevent a re-direction of fishing effort to immature crabs.
- Revised regulations for the harvest of scup, black sea bass, and fluke (322 CMR 6.22 & 6.28) pursuant to adjustments made by ASMFC for the 2010 recreational harvest limits and commercial quotas. *MarineFisheries* increased the commercial scup weir allocation; reduced the for-hire scup "bonus season" by ten days, but increased the general for-hire scup open fishing season by ten days; implemented a May 22 through September 12 black sea bass recreational fishing season; and increased the open recreational fluke season, implementing a May 22 through September 6 season.
- Revised measures for weakfish (322 CMR 8.06) to maintain compliance with ASMFC Addendum IV. *MarineFisheries* reduced the recreational creel limit to one fish, implemented a commercial trip limit of 100 lbs per 24-hour day or trip, whichever is longer, and maintained all other existing regulations.
- Revised measures for coastal sharks (322 CMR 6.37) to maintain compliance with the ASMFC interstate management plan, including recreational and commercial harvest regulations (e.g., prohibited species, trip limits, minimum size, gear requirements) and a federal dealer permit requirement.

Recreational Saltwater Fishing Permit

During 2010, *MarineFisheries* developed a recreational saltwater permit similar in cost to other northeastern states and less than the federal registry program. This effort followed the Governor's signing into law "An Act Instituting Saltwater Fishing Licenses," thereby allowing *MarineFisheries* to implement a recreational saltwater permit program. The permit fees for resident and non-resident recreational saltwater fishermen are $10, for resident charter boats $65, for non-resident charter boats $130, for resident head boats $130, and for non-resident head boats $260. The permit program and fees were codified in November

2010 and the resident and non-resident recreational permits became available online and at *MarineFisheries'* offices on December 21, 2010.

Active Outdoors, the nation's leading internet-based permit vendor, was contracted to develop the online permit purchasing system. Proceeds from this program go into a dedicated fund, the Marine Recreational Fisheries Development Fund, and will be used for projects to improve and promote the Commonwealth's recreational saltwater fisheries with one-third committed to improving public access to the fisheries.

Marine Recreational Fisheries Development Panel

Pursuant to provisions of "An Act Instituting Saltwater Fishing Licenses", *MarineFisheries* created a Marine Recreational Fisheries Development Panel. This five-member panel consists of two members of the MFAC and three members of the public at large, all of whom are to have specific expertise and background in the Commonwealth's marine recreational fisheries. The panel was developed to recommend how funds from saltwater permit sales should be allocated.

The panel held its inaugural meeting on May 19, 2010 to discuss its mission, set an agenda and action items for 2011, and appoint a chairman.

Shellfish Aquaculture

MarineFisheries held a public meeting on May 27, 2010 to discuss with aquaculture industry representatives, state legislators and the Massachusetts Department of Agricultural Resources (*MassDAR*) the potential harvest and sale of undersized aquaculture-reared shellfish. *MarineFisheries* agreed to condition aquaculture propagation permits so that the permit holder is authorized to harvest 2½ inch diameter aquaculture-reared oysters and 7/8 inch diameter aquaculture quahogs, provided the product is labeled as aquaculture-reared and sold exclusively to primary buyers on the Interstate Shellfish Shippers List strictly for resale out of state. In September 2010, *MarineFisheries* brought to public hearing a proposal that would amend the agency's regulations to codify these changes for 2011.

Whelk

Due in part to the significant decline in the Southern New England lobster stock, effort in the state waters whelk (conch) fishery, prosecuted primarily in Buzzards Bay and Nantucket and Vineyard Sounds, has risen dramatically in recent years. In April 2009, the Duke's County Martha's Vineyard Commercial Fishermen's Association petitioned *MarineFisheries* to increase the minimum size for whelk from 2¾ inches to 3 inches and institute a zero percent tolerance for undersized whelk. After discussing the minimum size increase with biologists, it was determined that the proposed increase may not be enough to protect the harvest of juveniles or protect spawning stock; more life-history information was needed. Further, the Office of Law Enforcement explained that a zero percent tolerance would not be enforceable. *MarineFisheries* committed to studying the whelk fishery with the goal of developing a management plan in 2011.

As a separate issue, the Director placed a moratorium on all whelk pot permit transfers on March 25, 2010 until further notice. This measure was enacted as part of a regulatory

package to protect horseshoe crabs. A marked increase in the whelk pot fishery added to a surge in demand for horseshoe crabs, the fishery's favorite bait type.

Groundfish

Seasonal Protection of Spawning Cod: Throughout this past decade, Massachusetts has taken a leadership role in promoting the conservation and protection of discrete spawning cod aggregations. In 2003, with the understanding that Gulf of Maine cod is a mosaic of remnant stocks that spawn seasonally in specific geographic locations, Massachusetts began to implement seasonal closures in isolated areas of Massachusetts Bay. Two closures, one in winter and one in spring, have become known as Cod Conservation Zones (CCZs).

In June 2010, *MarineFisheries* biologists found that cod remain in spawning condition in the Spring CCZ through the middle of July. To protect this spawning component from intense fishing pressure, the Commonwealth delayed opening the area from July 1 to July 21.

State Waters Groundfish Management: Amendment 16 to the Northeast Multispecies Fishery Management Plan (FMP) sets aside small amounts of each species and stock for non-federally permitted vessels fishing in state waters fisheries. In 2010, less than 100,000 pounds of the approximately 1.25 million pound cod set-aside had been landed in the Commonwealth by the end of July. In response, *MarineFisheries* authorized additional hook-and-line fishing in October in the area of Upper Cape Cod Bay and Massachusetts Bay otherwise closed to harvest as part of a "rolling closure." Letters of authorization were issued upon request to holders of a Massachusetts commercial fishing permit with a groundfish endorsement and that were up-to-date in their mandatory trip level reporting. Circle hooks were required, and an 800-lb. trip limit in effect.

Fluke

Winter Fishery Pilot Program: Massachusetts divides its annual fluke quota between the summer and winter fisheries, with the state waters summer fishery receiving 70% of the overall quota and the offshore winter fishery receiving 30%. To protect the state waters summer fluke allocation from potential offshore winter fishery overage, *MarineFisheries* implemented a conservative 500-lb. trip limit on the winter fishery.

A contingent of vessels from the winter fishery, led by former MFAC Commissioner Rodney Avila, petitioned *MarineFisheries* and the MFAC to liberalize the winter fishery's trip limit. They successfully argued that a 500-lb. trip limit was excessively restrictive for a multi-day offshore fishery and resulted in high levels of discarding. *MarineFisheries* created a pilot program whereby interested operators could apply for a vessel authorization to land 2,000 pounds of fluke per week beginning on January 1, 2011, provided the fluke would be sold to dealers who reported fish bought on a nightly basis. The reporting requirement allowed *MarineFisheries* to monitor landing rates in real-time to prevent an overage that would impact the summer inshore fluke allocation.

Menhaden

With considerable change to the dynamics of Boston Harbor, particularly increased boat traffic, *MarineFisheries* was challenged in 2010 to revise menhaden purse seining permit conditions. The Director issued revised permit conditions increasing the scope of areas in

Winthrop and Quincy harbors where seining was already prohibited or restricted and added Friday, Saturday, and Sunday closures in Boston and Salem harbors.

Striped Bass

Citing continued discard mortality, the Cape Cod Charter Boat Association petitioned *MarineFisheries* to develop rules requiring the use of circle hooks in the recreational and commercial natural bait striped bass fishery. The MFAC agreed to take this issue to public hearing in 2011.

In August 2010, environmental law enforcement officers informed *MarineFisheries* that the use of "yo-yo rigs" with detached weights in baits used in the striped bass fishery was becoming more prevalent throughout state waters. The use of this rig and technique results in metal sinkers and other materials embedded in bait remaining within the stomachs of striped bass, and this raised striped bass mortality concerns. The MFAC agreed to consider banning the use of this type of rig in 2011.

Members of the state legislature proposed a striped bass gamefish bill which would ban the commercial harvest and sale of this species in the Commonwealth. This bill did not move out of the Natural Resource Committee in 2010. Another bill was proposed to legalize spear fishing for striped bass in the Commonwealth; this bill was still under consideration at the end of 2010.

Black Sea Bass

MarineFisheries manages the Commonwealth's commercial black sea bass fishery in two seasons: a spring fishery and a summer/fall fishery. The Director establishes possession limits for the summer/fall season after a determination of available quota remaining from the spring fishery. In 2010, the summer/fall fishery opened on August 1 as planned, but with a reduced daily possession limit of just 50 pounds. Landings from the 2010 spring fishery that closed on May 24 occurred at unprecedented rates and consumed over 90% of the annual Massachusetts black sea bass quota (228,619 pounds) despite the 100,000-lb. increase in the state's overall quota from 2009 to 2010. The Director closed the summer/fall fishery effective August 16, when 100% of the quota was taken. The current low quota and high spring catch rates have made it extremely difficult to maintain both fishery seasons with existing regulations; *MarineFisheries* determined that alternative regulations should be proposed for the fishery in 2011.

Interstate and Federal Fisheries Management

Groundfish

MarineFisheries was active on several fronts with respect to groundfish management in general and Amendment 16 in particular. Amendment 16 implemented a "sector" system in the Northeast Multispecies Groundfish Fishery for the 2011 fishing year that started May 1, 2010. Sectors allow vessel owners to enter voluntary cooperatives to manage catch and bycatch limits as a group to mitigate the permit specific catch limits imposed by the National Marine Fisheries Service (NMFS). *MarineFisheries* provided comments during development of Amendment 16 in hopes of achieving the smoothest transition to catch shares.

Subsequent to implementation, three lawsuits against Amendment 16 were filed and later consolidated by industry members and the City of New Bedford. Several parties joined the suits including the city of Gloucester (plaintiff) and Conservational Law Foundation (defendant); the Commonwealth planned to join as an *amicus curiae*.

In the meantime, the Division partnered with researchers at UMass-Dartmouth's School for Marine Science and Technology (SMAST) through the Massachusetts Marine Fisheries Institute (MFI) at the Governor's request to provide a report justifying use of the Secretary of Commerce's emergency authority to raise annual catch limits (ACLs) for groundfish. "A Report on Economic and Scientific Conditions in the Massachusetts Multispecies Groundfishery" demonstrated that the transition to catch shares under Amendment 16 caused unforeseen major shifts in the distribution of quota (and income) resulting in $21 million in direct economic losses and forgone yield of $19 million for the Massachusetts groundfish fishery. Scientifically valid alternative reference points were identified which could increase ACLs without compromising conservation goals. These increases would be particularly helpful with regard to raising limits for "choke" species, those with the lowest quotas. We estimated that, under optimal sector operating conditions in which ACLs would be raised to the maximum amount scientifically justified while still maintaining conservation goals, increases would total approximately 32 million pounds more fish for the Northeast Multispecies fishery.

MarineFisheries entered into a Memorandum of Agreement (MOA) and related grant with the National Marine Fisheries Service for $1-million to operate a permit bank. This NOAA-funded, state-operated permit bank would provide aid to small-scale fishermen and ports through leasing of Days-at-Sea (DAS) and Annual Catch Entitlement (ACE).

The NEFMC also developed and approved Framework 45 in 2010. The management action included a suite of revisions to the sector program including measures to protect cod off the New Hampshire coast in an area known as "Whaleback". This closure affected recreational and commercial fishing in the areas. The Division had urged NMFS to utilize its emergency authority to reinstate the rolling groundfish closure in this area after it was repealed in Amendment 16, citing the need to protect spawning cod aggregations. NMFS failed to take action until the Council formally approved measures for a spawning closure.

Striped Bass

The ASMFC brought to public hearing a proposal to increase the commercial striped bass quota and revise the definition of juvenile recruitment failure. A public hearing was held in Dedham, Massachusetts on August 16, 2010. *MarineFisheries* and the Massachusetts ASMFC delegation did not support the quota increase due to concerns over a decrease in total abundance and declining recruitment from the Chesapeake Bay in recent years. The ASMFC did not adopt the quota increase, but did revise the definition of recruitment failure.

Southern New England Lobster

Environmental stresses, particularly an increase in average summer water temperature above 68°F (a biological threshold for lobsters), has caused a widespread decline in juvenile lobsters throughout the Southern New England Lobster Management Area (LMA). Historic fisheries in nearshore areas of Long Island Sound and Buzzards Bay have seen an 80%

decline in landings in the past decade. The ASMFC Lobster Technical Committee proposed a moratorium on the commercial take and harvest of lobster from southern New England, which received a tremendous amount of media attention. Since the initial consideration of a moratorium, the Technical Committee and the ASMFC Lobster Management Board have been deliberating management options for approval in 2011.

Spiny Dogfish

In March 2010, *MarineFisheries* and the Massachusetts ASMFC delegation were successful in promoting an increase in the 2010/2011 coastal spiny dogfish commercial quota from 12 million to 15 million pounds. This increase was based on a technical report indicating that spiny dogfish was no longer overfished nor subject to overfishing. In June 2010, the NMFS declared spiny dogfish rebuilt. Due to this quota increase, *MarineFisheries* enacted a 3,000-lb. trip limit beginning on May 1, 2010, similar to other northeast states.

Northern Shrimp

The ASMFC closed the 2009/2010 northern shrimp fishery on May 6, 2010, prior to the scheduled season end of May 29, based on landings data indicating that the harvest target of 4,900 MT had been met. To implement this closure, *MarineFisheries* promulgated an emergency action. With a 4,000 MT landings target for the 2010/2011 season (to account for a smaller population of northern shrimp), the ASMFC reduced the season length from 180 days to 136 days, setting a season of December 1, 2010 – April 15, 2011. The ASMFC planned to review the landings in February 2011 and adjust the season accordingly.

Atlantic Sea Scallops

Modification to 2010 Harvesting Rules: *MarineFisheries* worked with elected officials and the NEFMC to amend a decision about rules for harvesting sea scallops in 2010 (Framework 21). The Council, swayed by compelling economic arguments, agreed to allocate nine more "open area" DAS. Council members agreed that the risk of overfishing was acceptably low in terms of the economic costs associated with the DAS alternative approved in late fall. Both choices were supported scientifically by the Council's Scallop Plan Development Team (PDT).

Amendment 15: *MarineFisheries* participated in the development of Amendment 15 which was initiated primarily to bring the FMP into compliance with the revised Magnuson-Stevens Fishery Conservation and Management Act – namely the new federal mandate to set ACLs and Accountability Measures (AMs). During development of Amendment 15, other management proposals were added including "stacking and leasing" options to allow permit holders to consolidate permits and other fishing rights onto single vessels to address excess capacity in the limited access fleet. During the comment period, *MarineFisheries* provided a critique of the stacking and leasing proposals recognizing substantial industry opposition and unanswered questions about potential impacts and consistency with previously established policies. The Council rejected stacking and leasing options, but took action to update ACL provisions and biological reference points as well as to modify management measures for the Limited Access General Category fleet.

Framework 22: *MarineFisheries* participated in the development of Framework 22, a two-year specification package, which was approved for submission to NMFS in November.

Effort in open areas was set at the maximum level allowed under the hybrid overfishing definition revised and approved in Amendment 15 in September. As important as the allocations themselves, the Council approved an innovative fishing strategy that was developed by its PDT and fully supported by its Scallop Advisory Panel. The "split fleet trip alternative" is intended to promote as much access into scallop rotational areas as possible. Framework 22 also included a hard total allowable catch (TAC) for the Northern Gulf of Maine Limited Access General Category fishery (NGOM/LAGC) as well as a target TAC for LAGC vessels with an incidental permit (40 pounds per trip). The Council recommended that the hard TAC for the NGOM remain at 70,000 pounds and the incidental catch target TAC also remain at 50,000 pounds.

Atlantic Herring

The NEFMC continued to develop Amendment 5, which seeks to implement an effective monitoring program for the sea herring fleet and measures for the protection of river herring populations that are taken as bycatch in the fishery. *MarineFisheries* provided expertise and guidance during discussion of river herring and haddock catch caps through its participation on the Council, Plan Development Team, and the ASMFC.

Atlantic Bluefin Tuna

The country of Monaco petitioned to list Atlantic bluefin tuna (ABFT) under Appendix I of the Convention on the International Trade of Endangered Species of Wild Fauna and Flora (CITES). The proposed ban was not adopted at the March 2010 CITES Conference. *MarineFisheries* opposed a prohibition on the international trade of ABFT. The Division argued the International Commission on the Conservation of Atlantic Tunas (ICCAT) and the National Oceanic and Atmospheric Administration (NOAA) should be allowed to finish rebuilding the fishery under conservation agreements reached in November 2009. Further, recent research strongly indicated there are two ABFT stocks - an overfished Mediterranean stock and a healthy, well managed western Atlantic stock – therefore the ban would unfairly disadvantage the U.S. fishery, particularly Massachusetts which lands 80% of the U.S. quota.

Stellwagen Bank National Marine Sanctuary

MarineFisheries staff continued to serve on the Stellwagen Advisory Committee, which was busy in 2010 with development and implementation of the final revised management plan for the Stellwagen Bank National Marine Sanctuary.

Other Activities

Publications

DMF News: *MarineFisheries*' newsletter was published once in 2010. Volume 31 (1^{st} – 4^{th} Quarter) is available at: www.mass.gov/dfwele/dmf/publications/dmfnq410.pdf

***MarineFisheries* Technical Report Series:** *MarineFisheries* published seven reports in its technical report (TR) series. They are available at: www.mass.gov/dfwele/dmf/publications/technical.htm

"Massachusetts Division of Marine Fisheries trawl survey effort, list of species, and bottom temperature trends, 1978-2007." TR-38, by J. R. King, M. J. Camisa, and V. M. Manfredi.

"Massachusetts lobster fishery statistics for 2006." TR-39, by M. J. Dean.

"Proceedings of the international technical workshop on gadoid capture by pots (GACAPOT)." TR-40, by M. Pol, P. He, and P. Winger.

"Massachusetts striped bass monitoring report for 2009." TR-41, by G. A. Nelson.

"Quality assurance program plan (QAPP) for water quality measurements for diadromous fish monitoring 2008-2012, version 1.0." TR-42, by B. C. Chase.

"Technical guidelines for the delineation, restoration, and monitoring of eelgrass (*Zostera marina*) in Massachusetts coastal waters." TR-43, by N. T. Evans, and A. S. Leschen.

"River herring spawning and nursery habitat assessment: Upper Mystic Lake, 2007-2008." TR-44, by B. C. Chase, T. Callaghan, M. B. Dechant, and P. Patel.

"Seafloor sediment composition in Massachusetts determined using point data." TR-45, by K. H. Ford, and S. Voss.

DMF Strategic Plan: The Division published its first ever strategic plan in 2010. Finalized in November, the Strategic Plan will enable *MarineFisheries* to better manage the Commonwealth's marine fisheries and fishery habitat and address the emerging challenges of this new century. The five-year plan (2010 – 2014) assures the Division's work remains focused on its mission and vision. See: http://www.mass.gov/dfwele/dmf/publications/dmf_strategic_plan.pdf

Recreational Fishing Guides: *MarineFisheries* published separate finfish and lobstering/crabbing guides for 2010. These guides were distributed at Division permitting offices, trade shows, and various bait and tackle shops throughout the state. Electronic copies were also available online. A single guide covering recreational finfishing, lobstering and crabbing was planned for 2011.

A Report on Economic and Scientific Conditions in the Massachusetts Multispecies Groundfishery: Staff of *MarineFisheries*, as part of the Massachusetts Marine Fisheries Institute, co-authored this report documenting justification for a 32 million pound allowable landings increase for the Northeast Multispecies Fishery. The report was submitted by Governor Patrick to Commerce Secretary Locke.

Awards

In recognition of his lifetime commitment to the Commonwealth's commercial fishing industry, Tony Verga was honored by the MFAC, *MarineFisheries*, and the Department of Fish and Game with the Golden Cod Award.

Conservation Engineering Program

Personnel

Michael Pol, Program Leader
David Chosid, Marine Fisheries Biologist
Mark Szymanski, Assistant Marine Fisheries Biologist

Overview

Conservation Engineering (CE) collaborates with industry and others to reduce impacts of commercial fishing gear on non-target species. During 2010, innovative, scientifically-designed investigations of fishing technology and fish behavior in otter trawls, longlines, and fish pots were proposed and developed to completion.

Projects

Determining the Seasonality of Cod Pots

This two-year project, funded by the Northeast Consortium (NEC), to determine the seasonal vulnerability of Atlantic cod to two types of fish pots neared completion in 2010. Cod pots are a potential alternative fishing gear that incurs little or no discard mortality. Newfoundland-style, large, large-mesh, static pots were compared to Norwegian-style, smaller, small-mesh, off-bottom, dynamic pots in a controlled study from a commercial fishing vessel from November 2008 to November 2009. We concluded that either pot style may be effective for further development, that seasonality plays an important role in catch efficiency and should be exploited in further testing, and observation of near-field behavior of cod near pots is still vital and problematic. The project was the subject of a manuscript presented at the ICES Annual Science Conference and a poster produced for the NEC's 2010 Annual Meeting.

Development of a Spiny Dogfish Excluder in a Raised Footrope Whiting Trawl

This NEC-funded project was successfully completed. It aimed to exclude dogfish in the fall whiting trawl fishery along the coast of Massachusetts using an angled grate in the extension of the net. The project was a collaboration with fishermen Frank and Andrew Mirarchi of Scituate (Figure 1) and relied primarily on underwater video to assess the effectiveness of the grate. Grates with 50 mm (2 in) spacing were investigated for effects from color (white or black), placement angle, and direction (leading to a top or bottom escape vent). Spiny dogfish numbers were greatly reduced for all gear configurations based on video observations and catch collected from the codend. Catches of target species were sizeable. The reduction of spiny dogfish led to apparent increases in the quality of marketable catches, reductions in non-target species mortality, and decreases in the codend catch handling times. The study was the subject of presentations given at the ICES Annual Science Conference, the Hake 2010 International Symposium, and the NEC's 2010 Annual Meeting, and a manuscript submitted to the Journal of Fisheries Research.

Figure 1. Testing of the spiny dogfish excluder grate

NMFS Cooperative Research Partners Program

NMFS issued a call for proposals in 2010 that created a new paradigm in gear research in the region. Proposals that funded networks of researchers, managers, fishermen, and others replaced funding of individual teams. CE led and was awarded two of the eight funded network proposals and is a participant on two others. Of these four, two were merged based on nearly identical approaches. CE played only a supporting role in one project, SQUIDNET, which focused on bycatch reduction in squid fisheries. Other projects and their goals are described below.

REDNET – A Network to Redevelop a Sustainable Redfish Trawl Fishery in the Gulf of Maine: REDNET brought together a network of gear researchers, net makers, fishermen, NMFS Regional Office and Science Center members, Council staff, fish processors and others in an attempt to reestablish the redfish trawl fishery in the Gulf of Maine. CE staff and co-coordinators Pingguo He of SMAST and Kohl Kanwit of the Maine Department of Marine Resources arranged a kickoff meeting of network members on the Boston Fish Pier in November.

GEARNET – Conservation Engineering Marine Fisheries Initiative: Two individual projects, GEARNET and CEMFIN, were separately approved for funding in 2010; however, after consultation between the network coordinators, it became clear that many of the goals of the separate projects were identical. Consequently, the two projects were merged under the name GEARNET. The intent of the project was to identify vital, immediate gear research that could assist fishermen in their transition to sectors and under new catch limits. The projects provide some personnel support to CE as a means of creating capacity for the anticipated research projects and activities. Funding is also provided for arranging meetings

and buying equipment. The project was initiated in November 2010 with a series of meetings of fishermen, sector-by-sector.

BreakBag: This small project is implementing a fisherman's idea to develop an inexpensive, breakaway codend and signaling device. The BreakBag Project began in November 2010 with a meeting at the Quest Center for project participants (Figure 2).

Figure 2. Project participants met in New Bedford to discuss ideas for developing a breakaway codend and signaling device

Design and Testing of the Five-Point Trawl

The experimental Five-Point Haddock Trawl was designed to harvest Georges Bank haddock, while avoiding the weaker stock of Atlantic cod. This semi-pelagic, sweepless, raised footrope trawl net touches bottom with five drop-chains and exploits the rising behavior of haddock while passing over cod during the herding process. Continued catch comparisons of the Five-Point Haddock Trawl net and a separator panel trawl were conducted in May 2009. Results were reported to the Marine Fisheries Institute in 2010. Haddock, cod, and most flatfish catch results indicated that the experimental net does not perform significantly different than a separator trawl net; however, yellowtail flounder catch was significantly lower in the experimental net. Based on these strong reductions in Atlantic cod and proven overall stability, this net may be ready for inclusion into regulations for use along with other selective haddock nets.

Design and Test of a Squid Trawl with Raised Footrope Rigging and a Grid Device to Reduce Bycatch (SQUIDGRID)

CE teamed with Pingguo He, the lead on this NMFS proposal. The project is a partnership with net maker Tor Bendiksen and draggerman Mike Walsh, and it seeks to reduce bycatch in the Nantucket Sound squid fishery. The trawl was initiated by a shore-based test of squid dropped through grids of known size (Figure 3).

Figure 3. The SQUIDGRID net, a squid trawl with raised footrope rigging and grid device aimed at reducing winter flounder, scup, and butterfish bycatch

Comparison of Atlantic Cod Avoidance by Two Baits in Longlines Targeting Haddock (MACKBAIT)

A single-boat comparison of catch and bycatch in an inshore haddock longline fishery using mackerel and clams was developed during the reporting period, implemented, and then prematurely terminated when the industry partner discontinued his involvement after two trips. The project was developed under the direction of *MarineFisheries'* Dr. David Pierce. A proposal was drafted including study area and design, planning meetings, databases, and data entry forms.

Other Activities

Video

CE's resources include expertise in filming fishing gear in use and observing and recording fish behavior during the capture process. Project files include nearly 1,000 different individual videotapes and other media, used to study fish and fishing gear. The filming ability and our video library are used in collaboration with other *MarineFisheries* projects and other researchers outside *MarineFisheries*. In 2010, CE provided video of squid to assist NMFS, of flatfish for the Commercial Fishermen's Research Foundation, and of dogfish exclusion from a trawl with a grate.

Appointments

Michael Pol was appointed chair of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour, with a three-year term beginning in January 2011.

Michael Pol served on the coordinating committee for "Hake 2010: International Symposium on the Biology, Harvesting, Management and Conservation of Hakes", a NEC-sponsored symposium on May 11-12, 2010 in Portland, Maine. CE staff all presented talks discussing different aspects of hakes.

Michael Pol also served on the steering committee for the "2010 Northeast Regional Redfish Symposium", held in Danvers, Massachusetts on November 4, and also sponsored by the NEC. He teamed with fisherman Mike Walsh to discuss a fisherman's perspective on a redfish fishery.

Publications

Michael Pol co-authored the chapter "Fish Behavior Near Gillnets: Capture Processes and Influencing Factors" in the 2010 book, "Behavior of Marine Fish: Capture Processes and Conservation Challenges" (published by Wiley-Blackwell).

Management Information Systems and Fisheries Statistics Program

Personnel

Thomas Hoopes, Project Leader
Story Reed, Fisheries Data Collection
Kim Lundy, Dealer Reporting Coordinator
Brant McAfee, Data & GIS Analyst
Julian Race, GIS Analyst & Network Administration
Mary Ann Fletcher, Fisheries Data Entry
Rosemary Mitchell, Fisheries Data Entry & Licenses
Whitney Ryan, Contractor – Fisheries Data Entry
Erika Himmelberger, Contractor – Fisheries Data Entry
Leo Sahaya, Contractor - Oracle Database Developer

Overview

The **Management Information Systems (MIS) Project** provides many services to *MarineFisheries* under the umbrella of information systems/technology including: local area network maintenance; PC and server maintenance; Internet and Intranet website development and maintenance; Oracle database development and maintenance and geographic information systems (GIS) data development and assistance. With the consolidation of information technology services occurring across all state agencies in 2010, some of these services have been assumed by secretariat staff; however, unlike most other agencies in the Executive Office of Energy and Environmental Affairs (EOEEA), *MarineFisheries* staff on the MIS Project, who provide these services, were not consolidated. This was because they provide other services to *MarineFisheries* that are not specifically IT related. As a result, these individuals have, for the most part, continued to work in the same capacity as before consolidation.

The **Fisheries Statistics Project** collects fisheries dependent data from both commercial harvesters (catch and effort) and dealers designated as primary buyers (landings). Both data sets are collected in a standardized trip-level format from all permit holders. These data are used in many ways, both within *MarineFisheries* and to fulfill requests made from outside the agency. Project personnel also participate in the planning and development of the Atlantic Coastal Cooperative Statistics Program (ACCSP) and provide support to administrative staff for policy and law enforcement purposes, as well as permitting staff to issue permits from the Gloucester facility.

Management Information Systems Project

Website Development & Maintenance

The *MarineFisheries* website (www.mass.gov/marinefisheries) continued to be an extremely useful means of distributing information and consumes a significant percentage of staff

time. The year 2010 marked the beginning of a transition to a portalized web format to match the overall *mass.gov* website. An internal Intranet site using Wiki technology continues to provide both agency-wide as well as project-specific functionality to agency personnel. A Statistics Project Intranet site is also maintained for display of quota information, reporting compliance, and both harvester and dealer reporting information.

Oracle Database / Application Development & Maintenance

There are currently four production databases that *MarineFisheries* uses: Commercial Permits and Statistics (FISH2000); Lobster Sampling (LOBSAMP); Shellfish Sampling & Area Management (SHLFSH); Time Tracking for Federal Grants (TimeSheet). The Oracle contractor working for *MarineFisheries* made several enhancements to the FISH2000 application over the course of the year.

Other database application projects undertaken during the year include:

- Worked with Resource Assessment Project to set up a new data acquisition system onboard the R/V Gloria Michelle.
- Working with Shellfish Program to revamp the aquaculture permitting database/permit issuing system.

GIS Technical Assistance & Data Development

Project personnel have been working on the following projects in addition to providing support to agency staff:

- Department of Transportation / Anadromous Fish layer completed by consultant and in review by Anadromous Fish Biology and Management Project staff.
- Phase 1 of GIS data store revampment complete. Planning and fund-seeking for new GIS server underway.
- Working with the Massachusetts Office of Geographic Information (*MassGIS*) to develop a web-based interface for Shellfish Program GIS data layers.

Fisheries Statistics Project

Dealer Landings Data Collection

Landings or purchases of all marine species by seafood buyers from commercial fishermen were collected as part of the dealer reporting program. Starting January 1, 2005, all primary buyers not required by federal law to report electronically began reporting under state regulations. All data from these state-reporting dealers were entered electronically by dealers or submitted to *MarineFisheries* via paper forms and entered into the ACCSP Standard Atlantic Fisheries Information System (SAFIS) database by project personnel. All quota-based fisheries are monitored using these dealer data stored in the SAFIS database.

As of December 31, 2010, 1,674 businesses obtained a 2010 MA dealer permit of one kind or another. Of those, 467 (28%) were categorized as primary buyers, which meant they intended on purchasing one or more marine species directly from fishermen during 2010. As a result, these dealers were required to report their primary purchases, including products retailed themselves. Of the 467 dealers, 205 had a federal dealer permit which required reporting electronically to the SAFIS database. These dealers were categorized as “federal-

reporting" dealers. The remaining 262 dealers were categorized as "state-reporting" dealers.

Even though many of the primary buyers in 2010 had been primary buyers in years past, all were required to complete paperwork to confirm their buying intentions and their commitment to the dealer reporting requirements. This registration process not only provided a signed statement for enforcement purposes, if necessary, but also provided the means to monitor reporting compliance and track quotas.

For 2010, 166,158 transactions (not including negative reports) were entered into the SAFIS database, covering over 384,484 individual species landings, or 2.3 species per transaction. Of those, 18,763 transactions (or 11%) were entered by project staff. These transactions were submitted via paper form by dealers who elected not to submit their reports electronically, and were then key-punched by project staff using the ACCSP web-based electronic dealer reporting (eDR) application. This represents a considerable decrease from years past (e.g., 17% of transactions in 2009), as (1) all federally permitted lobster dealers were required to report electronically in 2010 for the first time, and (2) more dealers were submitting their transactions electronically rather than via paper reports. Finally, for those dealers that continued to submit paper reports, new procedures in which data were entered into a spreadsheet and then uploaded into the SAFIS database were developed to make the process more efficient. These procedures, coupled together with dealer-submitted data already in spreadsheet form, represented another 10,470 transactions.

Total landings (live weight) amounted to 682.5 million pounds, valued at $477.8 million. The top five species in order of value were sea scallop, American lobster, Atlantic cod, haddock, and Atlantic sea herring, totaling $357 million, or 75% of the total. When grouped together, inshore and intertidal landings of shellfish such as soft shell clam, northern quahog, blue mussel, and oyster amounted to 23 million pounds, valued at $25.6 million. Landings of crustaceans (lobster, crabs, and shrimp) amounted to 21.8 million pounds, valued at $56.1 million. Landed species with a total gross value over $1 million are shown in Table 1.
The year 2010 marked the fourth year where all data entered into the SAFIS database for Massachusetts, with the exception of certain offshore shellfish fisheries and large pelagic species, were used by NOAA Fisheries in their compilation of the Fisheries of the United States report.

Several fisheries were managed by quota in Massachusetts in 2010 and were monitored using the dealer reported landings in the SAFIS database. Automated scripts ran on a nightly basis and were displayed on the *MarineFisheries* website. On a weekly basis during the open season, staff reviewed compliance, by species, from dealers which had already purchased during the year, or in past years, and accounted for potential landings if the dealer did not yet report. A regression analysis was run at least once per week for each fishery still open, the results of which were used to estimate a closure date. Any overages were applied to the following year's total harvest.

Table 1. 2010 Massachusetts Landed Species with Value Greater than $1 Million*

Species	Pounds (Whole)	Value
Scallop, Sea	261,142,351	$252,222,300
Lobster, American	12,575,086	$49,471,724
Cod, Atlantic	15,369,485	$23,990,930
Haddock	21,083,097	$21,193,470
Herring, Atlantic, Sea	74,557,543	$10,236,950
Goosefish	8,749,976	$9,931,400
Clan, Ocean Quahog	129,077,702	$8,980,750
Oyster, Eastern	3,267,022	$8,183,069
Pollock, Atlantic	8,691,074	$7,187,851
Clam, Surf	42,391,469	$6,799,275
Flounder, Winter	3,340,671	$6,653,819
Tuna, Bluefin	936,347	$6,368,360
Clam, Soft	5,450,402	$5,974,954
Clam, Northern Quahog	8,913,867	$4,646,363
Hake, Silver (Whiting)	7,050,391	$4,253,105
Flounder, Plaice, America (Dab)	2,870,936	$4,149,913
Whelk, Channeled	2,743,305	$3,845,823
Flounder, Yellowtail	2,594,105	$3,691,317
Striped Bass	1,228,229	$3,594,148
Flounder, Witch (Gray Sole)	1,495,547	$3,373,560
Hake, Atlantic, White	3,234,230	$3,339,494
Crab, Jonah	5,689,500	$3,211,323
Skates	11,325,229	$3,137,052
Crab, Red Atlantic	3,105,392	$3,052,094
Swordfish	644,499	$2,223,752
Flounder, Summer (Fluke)	852,332	$2,097,811
Perch, Ocean (Redfish)	3,464,165	$1,837,038
Squid, Long Finned (Loligo)	1,544,487	$1,717,421
Scallop, Bay	706,815	$1,522,384
Skate, Winter	7,105,611	$1,488,314
Mackerel, Atlantic	12,156,110	$1,485,662
Dogfish, Spiny	6,439,983	$1,356,549

* Data completed through 1 April 2011

Fisherman Catch and Effort Data Collection

Starting in 2010, all commercial fishermen began submitting, on a monthly basis, comprehensive, standardized trip-level data for all commercial trips conducted under the authority of their MA commercial permits. Those individuals holding a federal permit with reporting requirements to NMFS (e.g., Vessel Trip Report (VTR)), were exempt from reporting to *MarineFisheries* for those activities occurring on their federally-permitted vessel. All other individuals were required to report to *MarineFisheries*.

This change eliminated the suite of species and gear-specific annual catch reports that were collected for years, some since the late 1960s, and has greatly enhanced the agency's capabilities to monitor catch and effort information in all commercial fisheries conducted by

Massachusetts commercial fishermen. It also meets the interstate standards promoted by ASMFC through ACCSP.

Although the collection of monthly reports of trip-level activities was started in 2010, 2009 annual catch reports were also collected as part of the 2010 permit renewal cycle. Thus project staff not only began processing the new incoming 2010 trip-level reports, but also processed and entered all 2009 annual reports.

All reports were processed and entered by project personnel at the Annisquam River Marine Fisheries Station in Gloucester. Annual reports were entered, for the last year, into the agency's Oracle database located on EOEEA servers.

Fishermen either submitted their trip-level reports in paper form or entered their fishing activities themselves on-line using the SAFIS eTrips application, a web-based program developed jointly by ACCSP staff and program partners. Project staff used the same application to enter data submitted on paper forms. Thus, the primary repository for all trip-level data, except those reported to NOAA fisheries, was the SAFIS database.

Grant support has been provided by ACCSP to help fund the cost of the increase in data entry services brought on by the new trip-level program. The grant stipulates that ACCSP receive all trip-level data submitted to *MarineFisheries*. Making SAFIS the primary repository fulfills this requirement and meets the needs of the Fisheries Statistics Project as data can easily be downloaded from the SAFIS database to be used for compliance and fisheries analysis.

In 2010, 7,897 commercial harvester permits were issued by *MarineFisheries*, of which 1,205 (15%) indicated they were for federal reporting vessels. The remaining 6,692 commercial permits issued were designated as "state-reporting", and of those, 1,946, (or 25%) chose to report electronically using the SAFIS eTrips application. However to date, 626 of those permit holders, or about one-third of the total, have not logged into their SAFIS eTrips account. Assuming these permit holders have reported via paper reports instead brings the total to 5,373 (or 68%) submitting paper-based reports to *MarineFisheries*.

As of May 1, 2011, 92,045 commercial trips that occurred in 2010 were entered in the SAFIS eTrips application. Approximately 17% of those trips were entered by commercial permit holders, the exact same percentage of active eTrips accounts, with the remaining trips entered by *MarineFisheries* staff. Given that 2010 was the first year this program was implemented, it took a while for a good portion of commercial permit holders to understand and comply with the new reporting requirements. As a result, a large percentage of reports were submitted late, often not until the end of the year when permits were renewed for 2011. Thus, *MarineFisheries* was inundated with reports at year's end and was still entering 2010 data throughout most of 2011.

One of the main questions about the new program was how well fisherman-reported harvest matched or tracked with dealer-reported landings. Figure 4 compare the numbers for striped bass in 2010. The results are encouraging as the figure indicates a relatively good match.

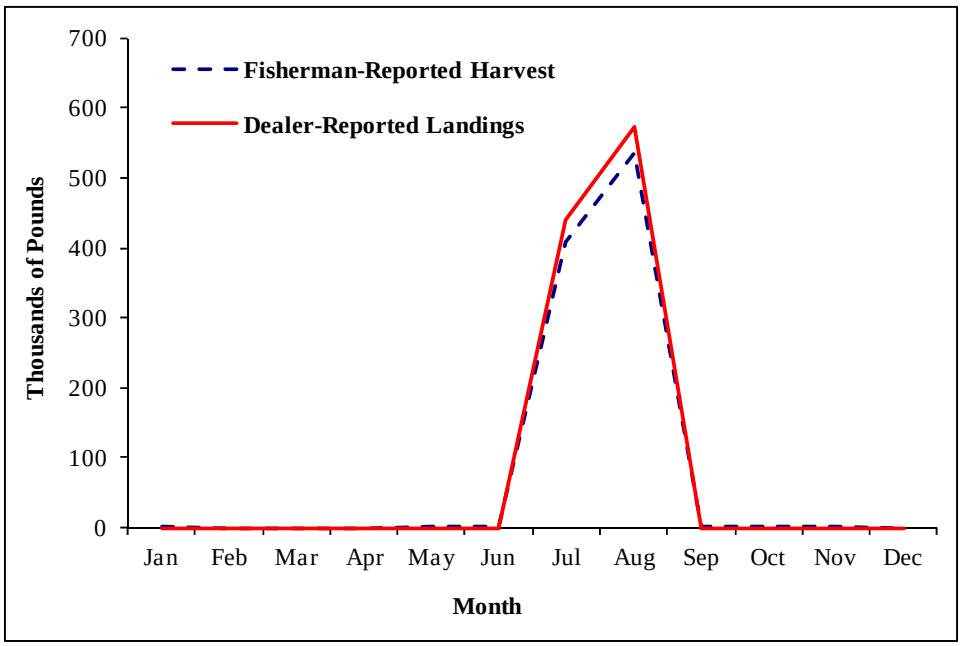

Figure 4. Dealer-Reported Landings and Harvester-Reported Catch of Striped Bass in 2010 (as of 19 May 2011)

Data Analysis and Dissemination

Primary duties involved filling fisheries data requests, quota monitoring and providing policy analysis support. Most data requests and analyses involved the lobster, groundfish, black sea bass, scup, fluke and other fixed gear fisheries. Additional technical support efforts aided development within the statistics intranet site as well as phone and regulation support to commercial permit holders.

Data requests varied widely in complexity, and in the amount of time required to execute them. The majority of day-to-day requests involved providing staff with current fishery landings and value information, as well as permit information. These requests are summarized in the bulleted list below.

- Continued monitoring of MA state waters groundfish landings and assessing their relevance within the context of sector management.
- Monitoring of MA northern shrimp landings and data support for MA northern shrimp fishery management.
- Monitoring quota landings generated from fluke pilot fishery beginning in January.
- Analysis of landings and price movements within the commercial black sea bass and scup fisheries.
- Filling public requests for MA commercial fisheries landings data.
- Data support for *MarineFisheries* and the Gulf of Maine Research Institute's lobster fishery mail surveys.
- Analysis of MA fluke permit activity by gear type.
- Analysis of recreational cod fishery off of Block Island, RI.
- Update and creation of new *MarineFisheries* statistics intranet pages designed for quota monitoring.

- Data support for horseshoe crab management plan and report to ASMFC.
- Assessment of historic shellfish landings within Mattapoisett town boundaries.
- Web support for posting advisories and changes to *MarineFisheries* website.

Other more involved data requests that spanned multiple days or required considerable time commitments are outlined below with specific highlights. Overall, data requests accounted for approximately 80% of time commitments, while technical support and development accounted for the remaining 20%.

Assessment of Sector Management Economic Impacts: This project emerged from a request by Massachusetts Governor Deval Patrick to investigate the economic impacts of the NMFS sector management policy. Both *MarineFisheries* and SMAST cooperatively analyzed available data to assess the preliminary impact sector management was having on MA sector vessels. Work stemming from the original SMAST/*MarineFisheries* meeting resulted in a jointly authored document (*A Report on Economic and Scientific Conditions in the Massachusetts Multispecies Groundfishery*), which was then submitted to Commerce Secretary Gary Locke. The document outlined the disproportionate impact of sector management across the MA groundfish fleet and provided rationale for federal aid. Data support for the analysis required pulling dealer reported revenue data by vessel and comparing these revenue numbers to multiple permit attributes to identify individuals adversely affected by the policy. This project is ongoing and in the future will involve more complex data queries and analysis, as well as expanded time commitments.

Vertical Line Model Development: This analysis was part of an existing relationship with Industrial Economics Inc. (IEc; a NMFS contractor), which is responsible for analyzing trends in the number of vertical lines deployed by fixed gear fishermen in New England over the past several years to reduce harm to endangered whales. *MarineFisheries* has provided data to IEc in the past relating to state water fixed gear fisheries and lent continued data support in 2010/2011. During the process of analyzing vertical line data, IEc developed a vertical line model capable of predicting numbers of vertical lines in specific areas during certain times of year. Development of the vertical line model required more detailed information from *MarineFisheries*, which required more complex queries. *MarineFisheries'* transition to trip-level reporting in 2010 complicated data retrieval due to changes in data collection methodologies and structure. Therefore, rectifying 2010 data with prior years' data required extensive work. In prior years vertical line data were reported by specific fishery; in 2010, vertical line and effort data were only reported by gear type, making it difficult to identify which fishery the data belonged in. Ultimately, an algorithm was developed in SQL that correctly apportioned effort by gear type and species landed to assist in categorizing 2010 effort data by fishery.

Development of Web-Based Trip-Level Summary Report Form: A web-based application for summarizing individual permit holder data was developed. The application resides on *MarineFisheries*' statistics intranet page and dynamically (i.e., on the fly) generates a summary report that describes reported landings and effort information for the specified permit holder and year. The application is widely used by statistics staff when assessing individuals' fishing activity and supplying summary information to permit holders.

Development of MA State Water Groundfish Monitoring Script: To assist rapid assessment of state waters groundfish landings, an R™ script was developed that automated the complicated process of compiling these landings. Previously, these data were difficult to

compile because they existed in three different databases, each of which has its own format. The procedure is now fully scripted into a batch file and is easily updatable.

ACCSP Participation and Planning

With the transition to trip-level reporting for all MA harvesters in 2010, continued procedural development occurred during the year, including the preparation, submittal, and acceptance for future funding support from ACCSP. *MarineFisheries* staff continued to provide feed-back to ACCSP with regard to the web-based applications eTRIPS and eDR. With both dealers and harvesters using these applications, this feed-back is a valuable part of the continued improvement of these applications. Fisherman permit and vessel information was routinely uploaded to the SAFIS database. Both the state boat registration database and the coast guard registration database were used to verify registration or documentation numbers for all vessels before adding the vessels to the SAFIS database.

Law Enforcement, Permitting, and Industry Interaction

Project staff routinely worked with *MarineFisheries* administrators and law enforcement on enforcement and regulatory issues. Staff provided data, support, and outreach to industry when needed. Support was also provided for the issuance of *MarineFisheries* commercial permits from the Gloucester facility, in addition to working with a contractor, Active Outdoors, to build the new recreational permitting system for both *MarineFisheries* and the Division of Fish and Wildlife.

Project staff worked with industry, law enforcement, and *MarineFisheries* administrators to create the Winter Fluke Fishery Pilot Program, and ensure that upon starting on January 1, 2011, the program could be sufficiently monitored through dealer reported landings and dockside observations by law enforcement. Other industry support was provided by phone and at meetings such as at the Massachusetts Lobstermen's Association annual meeting.

The Gloucester facility began issuing commercial permits in 2008 and only issued about 1% of the total issued for that year. As more permit holders became aware of the option to get their permit at this facility, a greater number have been issued from this location. In 2010, 5% percent of the commercial permits were issued from Gloucester, 13% from the New Bedford office, and 82% from the Boston office. Project staff have provided support both for permitting and regulatory questions as well as technical issues.

SHELLFISH AND HABITAT SECTION

J. Michael Hickey, Section Leader

Shellfish Sanitation and Management Program

Personnel

J. Michael Hickey, Program Manager

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John Mendes, Biologist
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Richard Hardy, Laborer
Peter Kimball, Laborer
Albert Thistlewood, Assistant Plant Foreman
Paul Thistlewood, Laborer

Overview

The Shellfish Sanitation and Management Program (Shellfish Program) has two primary missions: public health protection, and both direct and indirect management of the Commonwealth's molluscan shellfish resources. Public health protection is afforded through the sanitary classification of all 1,744,041 acres of overlying waters within the states territorial sea and Nantucket Sound. The National Shellfish Sanitation Program (NSSP) is a federal/state cooperative program recognized by the United States Food and Drug Administration (USFDA) and the Interstate Shellfish Sanitation Conference (ISSC) for the sanitary control of shellfish produced and sold in interstate commerce for human consumption.

Shellfisheries management is accomplished by direct *MarineFisheries* regulation of the commercial surf clam, ocean quahog, and quahog dredge boat fisheries, harvest of contaminated shellfish for depuration and relaying, and setting size and maximum harvest limits for other shellfish and seasons in the case of bay scallops and conchs. *MarineFisheries* also regulates shellfish aquaculture and is required to certify that operation of private shellfish aquaculture projects at sites licensed by coastal municipalities will not have an adverse impact on shellfish or other natural resources of the city or town. Indirectly, *MarineFisheries* manages through its partnership with the coastal communities by providing technical assistance in consultation with local management authorities (elected officials and shellfish constables) in the development of management plans and regulations to protect and conserve shellfish and by providing information pertaining to increasing the supply of shellfish and protection from predators and shellfish diseases.

Sanitation – Public Health Protection Project

Shellfish Sanitation

Public health protection is achieved as a result of sanitary surveys of shellfish growing areas to determine their suitability as sources of shellfish for human consumption. Sanitary surveys include: 1) evaluation of all pollution sources that may affect an area, 2) evaluation of hydrographic and meteorological characteristics that may affect distribution of pollutants, and 3) an assessment of water quality.

Each shellfish growing area must have a complete sanitary survey every 12 years, a triennial evaluation, and an annual review in order to maintain a classification which allows shellfish harvesting. Minimum requirements for each of the evaluations noted above and annual water quality monitoring are established by the ISSC and set forth in the NSSP. Each year, the South Shore segment of the Shellfish Program collects samples from 1,256 stations in 261 growing areas located in 41 coastal cities and towns at a minimum frequency of five times a year. In 2010, 7,118 water samples were collected on the South Shore and analyzed by *MarineFisheries* New Bedford laboratory. On the North Shore, water samples are collected from 238 stations in 17 growing areas in 16 communities. In 2010, the Gloucester Shellfish Laboratory analyzed 3,686 bacteriological water samples, a 10% increase over 2009 and approximately 23% increase since 2008. Coast wide, a total of 10,804 water samples were collected from 1,494 stations in 278 shellfish growing areas in 57 communities.

Shellfish program biologists completed 319 annual evaluation reports for growing areas or classification sub-units of growing areas, 98 triennials, 19 sanitary surveys, and 37 additional annual conditional rainfall management plan evaluations.

Shellfish are also tested for bacterial quality and various contaminants based on assessment of pollution sources impacting growing areas as determined by the sanitary survey and also as a result of pollution events such as oil spills and chemical spills or discharges. In 2010, 59 shellfish samples from growing waters were analyzed for bacterial quality, 32 from the South Shore and 27 from the North Shore. In addition to these 59 samples, another 904 shellfish samples were tested for red tide toxin, up 59% from 2009 and 9% from 2008. Of the 904 samples, 460 were from state waters and 444 for the Dockside Protocol Pilot Study.

Every time a shellfish growing area undergoes a change in either an NSSP classification or in an "Open" or "Closed" status for areas classified as "Approved", "Conditionally Approved", "Restricted" or "Conditionally Restricted", a legal notice is required by *MarineFisheries*. These notices reflect the type of opening or closure, the dates, the reason, and other pertinent descriptive information and are sent to municipal managers, the state Office of Law Enforcement, *Mass*DPH, USFDA and other interested parties. In 2010, 339 legal notices were written.

During 2010, the Shellfish Program was involved in a number of initiatives designed to improve shellfish classifications. Some of these were ongoing at the end of year and three resulted in classification changes. In April 2010, *MarineFisheries* reclassified 147 acres in Clarks Cove (BB 13) from Prohibited to Approved. Bordered by New Bedford and Dartmouth, this area of Clarks Cove was closed to shellfishing since the 1960s. Under the new classification, resulting from water quality improvements based largely on storm water upgrades, this new area is now open to shellfishing year around. Two areas of the West Branch of the Westport River in Westport were reclassified from Prohibited to "Conditionally Approved (rainfall). One 140 acre area (BB 3.12) is conditionally open from June 1 through April 30. Another 76 acre area (BB 3.19) is conditionally open from November 1 through April 30. These areas were reopened seasonally after being closed since May 2007.

Project staff continued extensive testing in the towns of Rockport and Hull to re-evaluate the sanitary quality of coastal waters presently classified as Prohibited. The reevaluation of the southeast corner of Joppa Flats in Newburyport continued in order to increase acreage of available conditionally restricted flat in area N2.1, the Merrimack River. Work on reclassifying Malibu Beach in Dorchester was completed for an early 2011 re-opening. A conditionally restricted classification allows for harvest of mildly contaminated soft-shelled clams by specially permitted diggers for depuration prior to sale to a seafood dealer.

Significant rainfall closures impacted productive softshell clam beds in Conditionally Restricted growing areas. The Annisquam River (N9) in Gloucester experienced partial or total closures on 33 occasions, followed by area GBH1 in Quincy, Weymouth, Hingham and Hull with 19 closures and 18 each in GBH3 and GBH5, Boston, Quincy and Winthrop. In total, 187 separate closures were instituted over 30 areas; 155 were rainfall-related and 20 emergency closures (Table 2).

Table 2. Shellfish growing area (SGA) closures in 2010 (Boston Harbor and North Shore)

SGA	Routine Rainfall	Seasonal	Marina	Emergency Rainfall	Emergency WWTP	Emergency PSP	Total by area
N2	14			1	1		16
N3				2			2
N4	13	1					14
N5	7	1			2		10
N6				2			2
N7	16				1		17
N8				2			2
N9	28	2			3		33
N10				1			1
N12				2			2
N21		1		2			3
N26	13	1					14
GBH1	16	2			1		19
GBH2	16						16
GHH3	16	2					18
GBH5	16	2					18
Total by type	**155**	**12**	**0**	**12**	**8**	**0**	**187**
Total by # of areas	**10**	**8**	**0**	**7**	**5**	**0**	**30**

As a result of USFDA and ISSC concerns about the naturally occurring pathogen *Vibrio parahaemolyticus* associated with raw oysters in the summer months, the temperature monitoring study using automatic temperature recorders which was initiated in 2008 was continued in 2010. Monitors were located at eight sites and other data were obtained from additional sources such as towns and Barnstable County. Temperature data will be used to annually assess the need for more stringent time to refrigeration requirements for the harvest of oysters during warm weather as required by the NSSP, or the need to monitor shellfish for the presence of *vibrios*. To date, average water temperatures have remained below threshold levels.

Program biologists also comment and make recommendations regarding U. S. Army Corps of Engineers National Pollution Discharge Elimination Permits (NPDES). In 2010, 11 permits including six municipal waste water treatment plants, required review and comment because of impacts to shellfish growing waters. Recommendations and comments involved end-of-pipe fecal coliform bacteria standards and facility chlorination requirements, along with impacts associated with other industrial discharges.

PSP Monitoring

Another major aspect of the shellfish program is monitoring for naturally occurring marine biotoxins produced by microscopic algae that can cause paralytic shellfish poisoning (PSP) or red tides. Consumption of shellfish containing certain levels of PSP toxin can cause severe illness and even death. Shellfish Program personnel collect shellfish from 15 primary stations weekly from March through mid-November. Samples are sent to the *MarineFisheries* Gloucester lab where bioassays determine the levels of toxin in shellfish. If toxin is found, both the frequency of sampling and the number of sample sites are increased. Shellfish areas are closed if toxin levels exceed safe limits. In recent years—2005 and 2008 especially—the intensity, duration, and spatial distribution of toxic algal blooms have increased.

The 2010 PSP season began on March 21 with three samples taken from the primary stations within the Nauset Estuarine System in the towns of Orleans and Eastham. The first closure was on April 7 for blue mussels only in growing area OC3 Roberts Cove and a portion of area OC2. One week later on April 14, the closure for those areas was extended to all species. The entire Nauset system was closed to all shellfishing just two days afterward, on April 16. These closures were in place until June 5, when all areas except OC6 Salt Pond in Eastham were opened to all species but moon snails. OC6 was opened to all species but moon snails on June 11. These closures represent a typical annual occurrence of PSP toxin within the Nauset Estuarine System. This event is considered separate and unrelated to the larger Gulf of Maine blooms. No other species closures were enacted for Massachusetts in 2010. Five other primary stations—one North Shore, three South Shore, and one Outer Cape—displayed toxicity, but none high enough to necessitate action. Figure 5 illustrates the extent of PSP closures within Massachusetts during 2010.

In addition to the area openings affected by toxicity occurring in 2010, an older single species closure on moon snails was lifted on May 8 in the Outer Cape and Nantucket Sound areas SC47, NS1, NS2, NT7, and NT8. This closure was enacted in the major bloom year of 2008.

A total of 904 shellfish samples were collected and tested for PSP during 2010. The samples support two activities: monitoring in state waters (451 blue mussel samples, four softshell clam, three moon snail, and two surf clam) and a dockside monitoring program for certain federal waters opened on a trial basis by NMFS (444 surf clam samples, both whole animal and homogenate). The PSP season for state samples concluded on October 18, after a 20-week period without any detectable toxicity.

In addition, during this same time period, 150 South Shore and 19 North Shore phytoplankton samples were collected and analyzed by several area biologists. This type of monitoring is based on relative abundance of phytoplankton using plankton nets and field microscopes and is directed at identifying the organisms that produce various biotoxins that cause PSP, Diarrhetic Shellfish Poisoning, and Amnesic Shellfish Poisoning. During 2010, there were no reported illnesses due to red tide in Massachusetts or attributed to Massachusetts shellfish in interstate commerce.

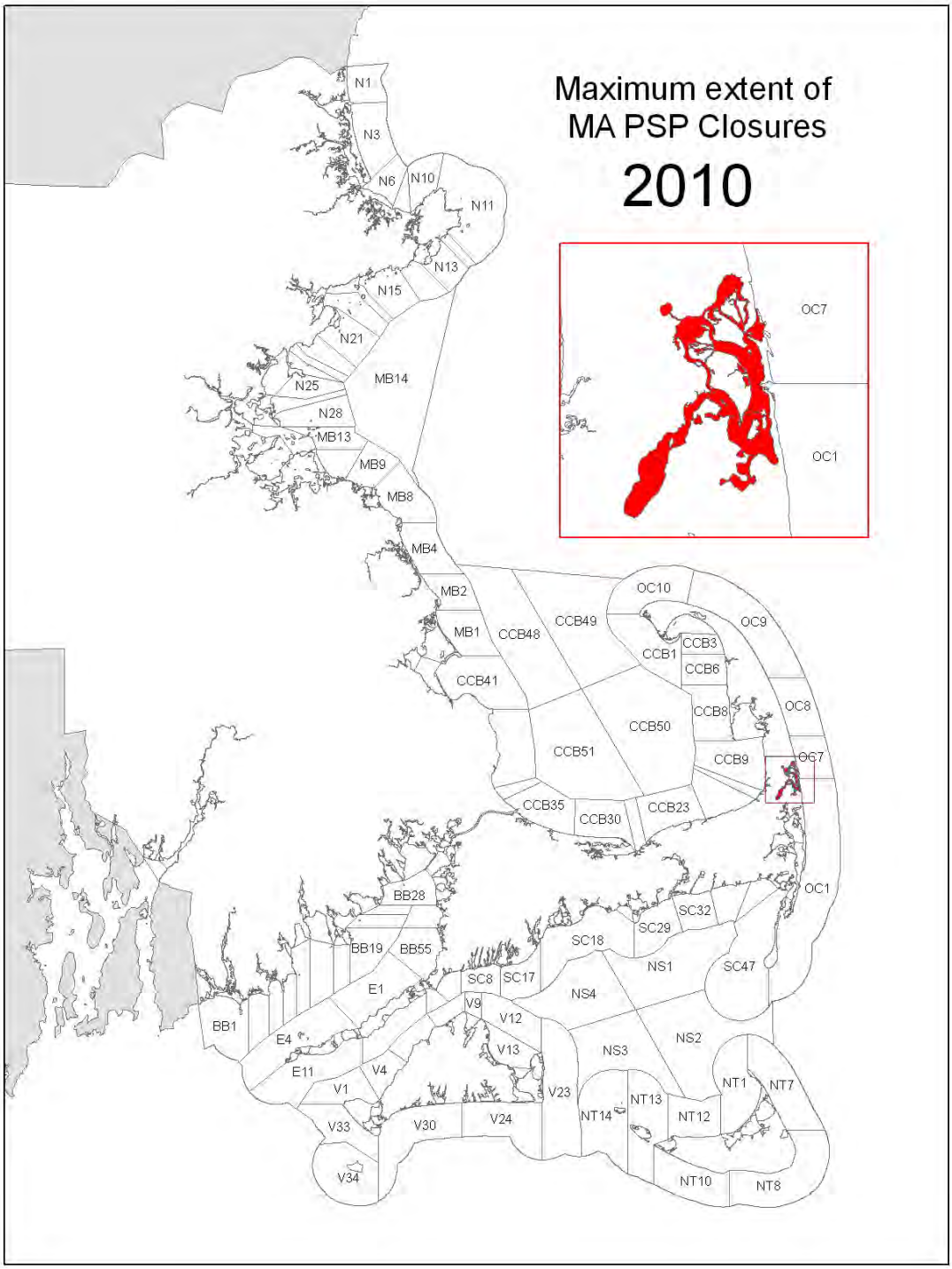


Figure 5. 2010 PSP Closure Areas off Massachusetts

Shellfisheries Management Project

Contaminated Shellfish Resources

MarineFisheries directly manages the contaminated shellfish resources for depuration, relaying, and bait.

Contaminated Relaying*:* *MarineFisheries* permits municipalities to relocate bacterially contaminated shellfish to clean waters for natural purification and propagation. Relays are conducted under stringent NSSP guidelines and are heavily supervised by state and local enforcement authorities. Contaminated shellfish must remain at the relay site for a minimum of three months and also for the duration of one spawning season. Shellfish are tested prior to relaying and again before harvesting for human consumption. Quahogs are most often transplanted, but oysters and soft-shell clams are also moved. During the past five years, between 6,400 and 8,600 bushels of quahogs have been moved annually from the Taunton River.

In 2010, sixteen towns participated in the program. A total of 8,575 bushels of quahogs were relayed from the Taunton River to various towns on the South Shore and Cape Cod, 250 bushels of oysters were relayed from North Bay (Barnstable), 95 bushels of oysters were relayed from the Pocasset River (Bourne), and 100 bushels of oysters were relayed from Tisbury Great Pond (Martha's Vineyard) under 18 Contaminated Relay Permits. Shellfish were transplanted to 27 locations. This method of shellfish propagation affords participating municipalities a relatively inexpensive source of shellfish to use as parent stock and reduces the temptation of illegal harvesting by removing the stock from contaminated areas. Despite the benefits, the amount of shellfish being relayed has decreased in recent years due mostly to reductions in municipal shellfish department budgets and not from the lack of available shellfish stock or interest in relaying.

Contaminated Bait: Currently, the only contaminated shellfishery for bait is the regulated surf clam fishery. Activity in 2009 was limited to landings of 1,094 bushels from prohibited areas of Nantasket Beach in Hull conducted by three harvesters. Landings in 2010 are confidential because there were less than thee active harvesters.

Depuration: The management and oversight of mildly contaminated soft-shelled clams, *Mya arenaria,* is a substantial activity for *MarineFisheries*. Clams are harvested from specially designated, "Conditionally Restricted" areas in Boston Harbor, Pines River, and the Merrimack River and transported by *MarineFisheries* licensed and bonded Master Diggers under strict enforcement to the Shellfish Purification Plant located on Plum Island in Newburyport. Once at the plant, the clams are treated in a controlled aquatic environment and purified. The Shellfish Purification Plant is a state of the art facility containing nine depuration raceways. Pure seawater is obtained from two deep salt water wells and is continuously disinfected using ultraviolet light. Depuration is a complex biological process requiring constant validation, during and upon completion of the treatment, through testing of shellfish and tank water. This is accomplished by daily testing in an on-site certified laboratory. The depuration process occurs for a minimum of three days and upon completion, the clams are returned to the harvesters, who pay a depuration fee. The purified clams are sold in commerce.

In 2010, the Shellfish Purification Plant received shellfish on a total of 173 days (runs) from 31 areas (down from 178 runs from 34 areas in 2009) and processed 512 lots of shellfish (down from 527 in 2009). A total of 14,829 racks (50-lb. dealer bushels) of softshell clams were received (Table 3), generating $88,974 in fees. All lots met release criteria in 2010.

As usual, production came from greater Boston Harbor, the Pines River, and the Merrimack River (Table 3). Except for the Merrimack River, all harvesting was divided between three digging groups: Boston diggers (digging Boston, Revere, Saugus, and Winthrop), Quincy diggers, and South Shore diggers (digging Hingham, Hull, and Weymouth). The Merrimack River is now being harvested by "open area" shellfishermen from the City of Gloucester.

Boston's 23% contribution to the plant is a dramatic increase from its 2009 contribution of 9%, whereas Revere-Saugus's contribution declined from 31% of all racks processed in 2009 to 15%. The remaining municipalities contributed a similar percentage of racks in 2010 as they did in 2009.

Table 3. 2010 Plant Production by Municipality

City/Town	No. of Racks	% of Racks
Boston	3,352	23%
Winthrop	2,947	20%
Quincy	2,892	20%
Revere-Saugus	2,265	15%
Hingham	1,256	8%
Weymouth	836	6%
Hull	763	5%
Newburyport	518	3%
Total	14,829	100%

Shellfish Plant Laboratory: Plant maintenance continued with installation of a new epoxy floor in the process area. *Mass*DPH inspectors continued monthly inspections throughout the year. The USFDA also evaluated the Shellfish Purification Plant process, finding the plant to be in compliance with NSSP guidelines.

The lab tested a total of 1,082 shellfish samples, 109 less than in 2009. Of these samples, 278 were "Zero Hour" samples, 235 "Mid" samples, and 569 "End Product" samples. In addition, 1,211 water samples were analyzed for fecal coliform, down from 1,333 in 2009. Laboratory sample production is primarily based on the total number of harvest days, i.e., more harvest days increases the number of shellfish lots which increases the need for depuration monitoring and quality assurance and quality control samples.

The geometric mean average of all Zero Hour shellstock product samples coming into the plant was 304 fc/100g (fecal coliform per 100g clam meat). The average Mid-1 treated sample was 92 fc/100g and Mid-2 was 27 fc/100g. Once again this year, the plant exceeded NSSP release criteria requirements with a geometric mean of 28 fc/100g for all released shellfish. The highest incoming count was once again from Hingham Harbor at 6,313fc/100g on August 5, 2010.

The Senior Bacteriologist and Depuration Program Coordinator attended or lead many meetings and tours of the Shellfish Plant again in 2010. In March, the lab participated in the

annual USFDA laboratory compliance evaluation and passed. The plant hosted a 75th anniversary open house in July attended by over 200 people.

Boston Harbor Soft-Shell Clam Enhancement

During spring 2010, *MarineFisheries* and its partners committed to a fifth year of enhancement and monitoring of softshell clams (*Mya arenaria*) in Boston Harbor. In 2010, the plan was to plant 1.62 million juvenile clams at five sites in Hingham, Hull, Revere, Quincy, and Weymouth. Due to slow growth of hatchery stock late in the growing season, the number was reduced to 1.46 million 10-12.5 mm juvenile clams. *MarineFisheries* personnel monitored the enhanced plots regularly throughout the growing season. Predator exclusion netting was removed from the 81 plots, corner stakes were installed on select plots, and GPS coordinates documented in November and December.

MarineFisheries personnel completely harvested two enhancement sites that were stocked during summer 2008 in Weymouth and Winthrop to assess survival and growth of stocked clams during their second year after planting. Data from the site in Winthrop are believed to be compromised due to unauthorized digging in the enhancement site, and therefore unusable.

To better understand the influence that acidification might have on soft shell clam stocks within Greater Boston Harbor, sediment pH monitoring of enhancement sites was begun during the 2009 season and continued throughout the 2010 season. A baseline data set of sediment pH levels in Boston Harbor is intended to relate clam growth, survival, and recruitment to pH sediment levels over the course of the next several years. Next, *MarineFisheries* began a pilot project with St. Joseph College in Maine to assess the impact of adding a calcium carbonate buffer to seeded plots on the growth and survival of seeded clams. Decomposition of sedimentary organic matter can result in the undersaturation of carbonate in the sediments where seeded and newly settled clams burrow following settlement. A decrease in the carbonate saturation state can adversely impact the development and survival of juvenile bivalves. To assess the value of supplementing carbonate in potentially undersaturated sediments on the growth and survival of seed clams a commercial grade calcium carbonate substitute was added to select plots within the Revere Pines River 2010 enhancement site. More work is planned for the 2011 field season.

pH sampling showed levels across the plots became more homogenized with the addition of the buffer. Initial sampling in December 2010 revealed that plots treated in June 2010 showed a significant dissolution of the added buffer versus a plot treated in September 2010 which still held most of the added buffer. Sampling revealed no major difference in the growth rates of clams seeded in treated plots. More work is needed to evaluate the normal dissolution time of the carbonate buffer; however, the rapid dissolution of the buffer in the plots treated earlier in the season may be the result of a decrease in the carbonate saturation state at some point during the early summer.

Since 2006, *MarineFisheries* and its partners have developed enhancement methods which have resulted in consistent soft shell clam survival at numerous sites throughout Boston Harbor. Research showed that clam size, sediment type, and beach kinetics significantly influence clam survival. Planted clams larger than 10mm in length exhibited a higher survival rate than smaller juveniles. Smaller juvenile clams that were planted in silty mud did not

survive. Similarly, enhancement sites that were exposed to significant tidal current, stream flows, wind driven waves, or vessel wake suffered high levels of clam mortality.

Following the 2006 pilot study, larger juvenile clams (10-15 mm) were planted in more suitable habitats and the restoration team has sampled the sites for clam growth and survival. Although clam growth varied between sites, within 1½ years of growth, between 50% and 75% of the planted clams grew to the legal size of two inches (50.8 mm). By year two, virtually all of the planted clams grew to legal size. Because soft shell clams can reach sexual maturity at a shell length of approximately 35 mm, our growth data suggests that a portion of the planted clams spawn during the late summer of the following year, and that most if not all of the clams spawn during the spring and summer of their second year. It is hoped that clams planted within the restoration sites successfully spawn over the course of two to three years, thus replenishing the clam beds within nearby tidal flats.

Survival of planted shellfish is probably the most important parameter that restoration teams need to assess in order to gauge the success and impact of a particular enhancement program on shellfish resources within the targeted area. Protection of enhancement sites from unauthorized harvesting is of key importance to understanding the factors impacting the growth and survival of out-planted shellfish. Data collected from plots believed to have been compromised has little scientific value; however, determining if a site has been compromised is difficult. During the 2010 season, buoys were deployed at 15 sites to delineate closed enhancement areas in efforts to protect the validity of the plots.

MarineFisheries continued to build and expand the network of local communities, commercial shellfishermen, and state agencies with the long term goal of enhancing the soft shell clam resource within Boston Harbor.

Technical Assistance Project

In Massachusetts, the cities and towns manage the shellfisheries in all waters within their boundaries that are not closed by *MarineFisheries* for public health reasons, with the exception of commercial harvest of surf clams and ocean quahogs that remain under state control. The Shellfish Program assists municipalities concerning a wide variety of shellfisheries management issues by providing technical and regulatory information as well as recommendations to local shellfish managers. Assistance is furnished regarding shellfish propagation techniques, predator controls, shellfish survey methods, management openings and closures, habitat improvements, shellfish management plans, aquaculture development and regulation, water quality, sanitation and public health, and permitting. Each shellfish biologist and the program supervisor provide technical assistance to municipal managers and boards, state and federal agencies, academia and non-governmental research and management organizations, and individuals. It is estimated that throughout 2010, staff rendered technical assistance on over 4,000 separate occasions to more than 2,000 entities.

Environmental Protection Project

Shellfish Program personnel respond to pollution events in coastal waters in order to assess possible damage to shellfish resources and to determine the need for public health closures. These events include sewage discharges, boat sinkings, petrochemical spills, and other discharges of hazardous chemicals. Several events are detailed below.

In addition, the Shellfish Program co-reviews with other *MarineFisheries* staff various proposed coastal alteration projects with regard to impacts on water quality, shellfish resources, and shellfish habitat. Recommendations are made through the *MarineFisheries* environmental review process to the permitting agencies concerning the effects of proposed structures, and filling or discharges into the marine environment. In 2010, approximately 443 proposed projects in 49 communities were sent to the Shellfish Program for some level of review and comment. Projects ranged in size from private docks to large projects such as the Weaver Cove LNG terminal in Fall River, the Cape Wind proposal in Nantucket Sound, and runway safety area improvements at Logan Airport in Boston.

Program staff, principally Neil Churchill and the Program Chief, also participated in periodic meetings with the United States Coast Guard (USCG), NOAA, and *Mass*DEP relative to oil and hazardous material spill contingency planning and drills. This involved membership on two committees developing Area Contingency Plans and state Geographic Response Plans for oil and hazardous substance discharges in both Massachusetts Coast Guard Sectors. In addition, both individuals were involved in contingency planning related to compensating for relocated assets to the Deepwater Horizon Oil Release in the Gulf of Mexico should a large spill occur in Massachusetts.

Sewage Discharges: On September 15, there was a sewage discharge (volume unknown) into the Trunk River which empties into Falmouth Harbor. The impacted 3,510 acre area (SC 5.0) was closed to shellfishing for 14 days and reopened on October 1. On November 5, there was a 7,000 gallon sewage discharge into the Jones River which empties into Kingston Bay. The portion of Kingston Bay that supports shellfish aquaculture operations (CCB 43.3) was re-opened to the harvest of aquaculture-reared oysters seven days later (November 11).

F/V ESS Pursuit (Mustard Gas) Incident: On the morning of June 7, USCG Sector Southeast New England received reports that two individuals working on the FV ESS Pursuit, a clam dredger, were being treated in New Bedford for potential mustard gas exposure. Emergency medical technicians based their conclusion on the symptoms exhibited by the individuals, which included blisters and difficulty breathing. While the vessel was fishing, ten canisters were dredged up about 50 miles south of Long Island, NY. One canister was broken and suspected of containing mustard gas. All of the canisters were thrown back into the ocean. The area where the canisters were found is known to contain unexploded ordnance. The fishing vessel was escorted back to New Bedford Harbor by the USCG, where it was isolated. The USCG, with support from the Department of Defense (DOD) took the lead to check the ship and its catch for contamination and direct any necessary decontamination. The National Guard Civil Support Team was activated for support by DOD. *Mass*DPH, Massachusetts Department of Environmental Protection (*Mass*DEP), *Marine Fisheries*, Department of Fire Services, City of New Bedford, U.S. Environmental Protection Agency, and U.S. Customs and Border Protection were among the many agencies involved.

The ship and crew had to be decontaminated and the entire catch of 486,897 pounds of clams removed and destroyed. After considering many options including ocean dumping, the clams were loaded onto 17 trailer trucks for transport to incineration facilities in Arkansas and Texas.

Menemsha Coast Guard Station Fire: On July 13, Menemsha Pond (V:2) and Nashaquitsa Pond (V:3) were closed to shellfishing following a massive fire on the Coast Guard Pier and

boat house in Menemsha on July 12. The fire and subsequent fire fighting activities resulted in charred, creosoted timber debris and light oil sheens throughout the area. The ponds were closed as a precautionary measure. The concern was over hydrocarbons and other hazardous chemicals that might have entered the water as a result of the fire. Possible vectors for the dispersal of hazardous contaminants included floating charred materials, creosote debris, and the numerous boats that were damaged by the fire. Oil containment booms were put in place around the area of the fire to isolate any materials in the water and also to protect both Menemsha and Nashaquitsa Ponds. Following numerous inspections of Menemsha Pond and discussions with *Mass*DPH and *Mass*DEP managers, Menemsha and Nashaquitsa Ponds were re-opened to shellfishing on July 28. The decision to re-open the areas was based on the assessment that the shellfish beds had little contact with any contamination, that Menemsha Pond was flushed many times over with water from Vineyard Sound, and there was no residual contamination within the affected areas.

Aquaculture Management Project

The regulation of shellfish aquaculture is a major management and technical assistance endeavor of the Shellfish Program. This activity involves two areas of concern: licensing of sites by municipalities, and the permitting of aquaculturists to obtain and possess sub-legal shellfish (seed) for transplant and grow-out to legal size. *MarineFisheries* assists the industry and municipalities by certifying (after inspection of the project site as required by Massachusetts General Law, Ch.130, Sec. 57), that license and operation will cause no adverse effect on shellfish or other natural resources of the city or town. The required *MarineFisheries* permit is designed to allow possession of seed and to prevent the introduction of shellfish diseases, non-native species, and other pests or predators that could decimate natural populations and ruin both aquaculture and wild commercial fisheries.

In 2010, 32 new private aquaculture license sites in 10 towns totaling 243 acres were surveyed and the sites approved. In addition, aquaculture permits (a.k.a. propagation permits) were issued to 309 license site holders operating shellfish aquaculture projects on 389 sites totaling 1,027 acres in 29 coastal towns. The 2009 value of shellfish marketed by growers, as reported in 2010, was $8,551,272 based on average wholesale price. This is a 17% increase of $1,234,490 from 2008. Reported production in bushels for 2009 was: quahogs 15,983; oysters 62,335; soft shell clams 2,025; and bay scallops 5,218. Other related activities include: assisting individuals in the licensing and permitting process, providing information on aquaculture to interested parties, assisting municipalities with site selection prior to formal site survey in order to avoid *MarineFisheries* denial, and assisting growers in finding seed sources and working with hatcheries to become certified to sell seed in Massachusetts. An annual aquaculture report is prepared describing marine aquaculture activities. A list of *approved* shellfish hatcheries is maintained on the *MarineFisheries* website.

Shellfish Program staff participated in the biennial Northeast Aquaculture Conference and Exposition which was held in Plymouth, MA, December 1 – 3. The exposition brings together aquaculturists and other interested parties from Maine to West Virginia. Shellfish Program biologists set up and staffed a booth within the exposition trade show. Informational brochures and posters highlighting the Shellfish Program and its relationship

with and contribution to shellfish aquaculture within the Commonwealth were made available to interested industry and non-industry participants. The following three talks were presented at the conference by Shellfish Program staff:

1. Oyster Growing Area Water Temperature Monitoring Related to Potential for *Vibrio parahaemolyticus* – J. Michael Hickey
2. Massachusetts PSP: a fifteen year retrospective – Gregory Bettencourt
3. Restoration and Enhancement of Softshell Clam (*Mya arenaria)* Populations in Boston Harbor, Massachusetts – Thomas Shields

These presentations were posted to the exposition's website:
http://www.northeastaquaculture.org/presentations-2010.htm

Other Activities

The Shellfish Program continued to participate in the activities of the ISSC, the primary agency involved in setting standards for the NSSP that regulates shellfish sanitation. Shellfish Program Supervisor, J. Michael Hickey, was Chairman of the Executive Board and either chair or member to an additional six committees. He was responsible for the appointment of committee members and coordinating committee and Executive Board activities with assistance from conference staff. Program Chief Hickey was also a member of the ASMFC Interstate Shellfish Transport Committee.

Program staff participated in professional organizations such as the Northeast Shellfish Sanitation Association, the Massachusetts Shellfish Officers Association, and the New England Estuarine Research Society. In addition, the laboratory staff participates in training and workshops of the Northeast Laboratory Evaluation Officers and Managers funded by the USFDA.

As the only USFDA certified Laboratory Evaluation Officer in Massachusetts, Susan Boehler was responsible for evaluating all laboratories involved in bacteriological analysis of water or shellfish acceptable to the NSSP and ISSC. This involved two *MarineFisheries* labs, a Massachusetts Water Resources Authority lab, a City of New Bedford lab, and a single industry lab.

Shellfish Program staff, under the direction of Tom Shields, worked throughout the fall with the Massachusetts Shellfish Officers Association, other agencies, and the Massachusetts Maritime Academy to update a planned two week Shellfish Officers Training Course scheduled for late January 2011 at the Maritime Academy.

Habitat Program

Personnel

Dr. Kathryn Ford, Program Manager
Tay Evans, Environmental Analyst
Eileen Feeney, Program Coordinator
Dr. John Logan, Environmental Analyst
Mark Rousseau, Environmental Analyst
Steve Voss, Assistant Marine Fisheries Biologist

Overview

The goal of the *MarineFisheries* Habitat Program is to protect and enhance marine fisheries resources by providing review, information, and policies, and conducting fisheries habitat research and restoration. The objectives of the program are to provide science-based technical review regarding potential impacts of construction activities to fisheries resources and habitats of the Commonwealth, to initiate and perform fisheries habitat research and applied studies, and to oversee the Division's climate change program. The Habitat Program provides input to the marine alteration project review process resulting in significant guidance to other agencies and jurisdictions in evaluating potential impacts from proposed construction projects.

In 2010, Habitat Program staff reviewed 592 projects, continued drafting marine resource recommendations for Cape Cod dredging projects, succeeded in having time of year recommendations incorporated into the Army Corps General Permit, updated the in lieu fee mitigation program, and finalized eelgrass restoration site selection work. The Habitat Program conducted video sampling and analysis on a research cruise aboard the EPA vessel, R/V Bold, in Cape Cod Bay using an SMAST video camera system. We also entered a partnership with MIT SeaGrant to conduct side-scan sonar mapping of eelgrass beds. The Habitat Program addressed concerns about the Gulf of Mexico oil spill to state legislators, drafted a climate change strategy for *MarineFisheries,* presented information regarding the impact of chlorine on lobsters for the Marine Fisheries Advisory Commission, and represented *MarineFisheries* on a variety of committees. All personnel actively engaged in field work, including reef sampling, seagrass monitoring, and restoration projects and studies, and support for other projects including the trawl and ventless lobster surveys and striped bass tagging.

Technical Review Project

The goal of the Technical Review Project is to protect and enhance marine fisheries resources by providing information regarding those resources to regulatory agencies during coastal alteration permit review. This project is also responsible for recommending mitigation and following mitigation projects. To meet these goals, project staff track coastal and marine construction projects, solicit specific resource information from *MarineFisheries* biologists, conduct literature reviews and site visits as necessary, write project comment letters, review options for compensatory mitigation, and participate in interagency

meetings. The Project also creates programmatic approaches to resource recommendations, improves access to coastal resource information, and supports research specific to review needs.

Technical Review

The Project continues to respond to a high volume of requests for technical review for specific construction permits as well as for reviewing state and federal policy documents. In 2010, 592 specific projects were reviewed. We welcomed Dr. John Logan as a full-time reviewer in April. Part-time assistants continue to play a vital role in maintaining consistency in the logging and response to reviews in both field offices.

Major review projects included Logan Airport runway improvements, Muskeget Channel tidal energy, Weymouth Fore River Bridge replacement, Peabody square flood mitigation projects, Merrimack river dredging and Newburyport/Salisbury beach nourishment, and Federal Realty Sturtevant Street Somerville 72-inch storm drain. They all involved multiple meetings, workgroups, and interagency communications due to the complexities of the proposals.

Time of Year Work Windows

Two major projects that were released in draft form in 2009 received multiple updates in 2010 and are anticipated to be completed in 2011. The first was a comprehensive update of our time of year recommendations. This report includes robust, literature-supported explanations of how the recommendations are established and involved consultations with many experts, both within and external to *MarineFisheries*. The timing of this project coincided with an update of the Army Corps General Permit, so it was tailored to be included in that Programmatic Permit. The second project involved creating a programmatic time of year recommendation for the Barnstable County Dredge. This effort involved creating a habitat map for all Cape Cod embayments, linking dredge locations with resource information. Both of these projects were discussed at length with other resource agencies and town representatives.

Anadromous Mapping

In the interest of generating a programmatic approach to time of year work windows for the Massachusetts Department of Transportation (*Mass*DOT) Accelerated Bridge Program, a project was initiated to map all of the streams and spawning habitat for anadromous species. The *Mass*DOT-funded project is utilizing the data and expertise of several *MarineFisheries* biologists, and both *Mass*DOT and *MarineFisheries* will benefit from the spatial database of fish runs.

Standard Protocols

In order to achieve improved consistency with our review of projects, the Technical Review Manual was initiated in 2009 and will be completed in 2011. A component of this larger vision was a comprehensive document describing the data needs associated with assessment of impacts on marine fisheries resources. A draft titled **"**Essential data for assessing biological impacts to fisheries resources and habitats from construction activity" is

currently under review within the project, and is anticipated to be published in the Technical Report Series.

In Lieu Fee Program

This was the second year of the *MarineFisheries* and Army Corps of Engineers (ACOE) In Lieu Fee program. This program provides a mechanism for mitigation requirements associated with impacts less than one acre in extent. Due to changes in the ACOE mitigation rules, the memorandum of agreement is currently being updated. No restoration projects have been funded to date.

Fisheries Habitat Research Project

The goal of the Fisheries Habitat Research Project is to conduct research, monitoring, and restoration relevant to the mapping, identification, and quality of marine fisheries habitats (Figure 6). This project also aids in the creation of new data products (e.g., seafloor maps) now viewed as necessary in the fisheries management community. Project staff serve on a variety of habitat-related committees, including the ASMFC Habitat and Reef Committees, the Atlantic Coastal Fish Habitat Partnership, the NEFMC Habitat Plan Development Team, and the Coastal and Marine Ecological Classification Standard working group.

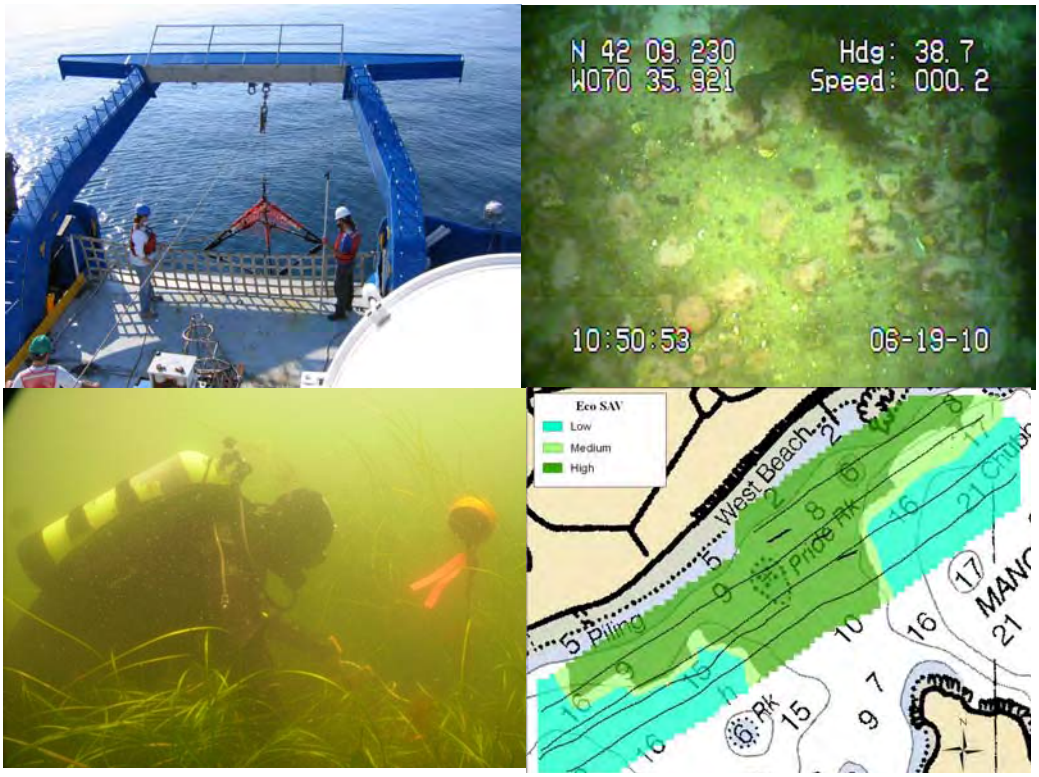


Figure 6. Clockwise from upper left: deployment of a frame-mounted video camera for seafloor imaging on the R/V Bold; seafloor off of Plymouth; aquatic vegetation mapping with the Biosonics DT-X; *MarineFisheries* diver on SeagrassNet site in Manchester

Sediment Database

The Habitat Research team assembled sediment data from grab sampling and video sampling to create seafloor substrate maps for the Ocean Management Plan. We continued to compile additional datasets and prepare the dataset for release to the *Mass*GIS and NOAA's National Geophysical Data Center. The technical report describing the data set and a quality assessment were released in early 2011.

The Habitat Research Team conducted research focused on furthering seafloor mapping. A bathymetric study of Padanaram Harbor, done in conjunction with the Dartmouth Harbormaster, was completed in the spring of 2010. In the summer of 2010, the Habitat Research team conducted video sampling and analysis on a seven-day oceanographic cruise aboard the R/V Bold, an EPA research vessel. SMAST donated the video system we used to collect 200 seafloor images in order to test the quality of existing maps. In the anticipation of doing more video research, a thorough inter-comparison of three analysts was conducted. Further, classification methods were tested to examine the utility of the available classifications. Lastly, we entered into a partnership with MIT SeaGrant to utilize sidescan sonar for seafloor mapping. The instrumentation was optimized for shallow water work anticipated for 2011.

Eelgrass

The Habitat Research team continued to expand on its eelgrass expertise. *MarineFisheries* was awarded a contract in 2009 to restore eelgrass damaged as a result of the construction of the HubLine pipeline. This work was initiated in 2010 and involved preliminary site work to confirm the locations of sites to be planted in 2011. We also participated in an eelgrass genetics study, and began collaborating on a NOAA grant to conduct eelgrass research in mooring scars. Associated with the NOAA grant, we used SCUBA to measure eelgrass parameters within scars and the Biosonics DT-X Echosounder to map the percent cover of submerged aquatic vegetation. The Habitat Research team completed the third year of SeagrassNet sampling with the help of the *MarineFisheries* dive team. We monitored an eelgrass bed in Salem Sound each quarter in support of the international SeagrassNet monitoring program. *MarineFisheries* continued to coordinate the Massachusetts Seagrass Group, an informal network designed to maintain and improve communications across researchers and managers involved with seagrass. Tay Evans contributed a report on technical guidelines for the delineation, restoration, and monitoring of eelgrass in Massachusetts coastal waters to the Division's Technical Report Series.

Artificial Reefs

The Habitat Research team continued to support efforts involved with establishing an artificial reef in coastal waters of Harwich. Sidescan sonar, underwater video, and diver transects were used to characterize an existing artificial reef site and a proposed site that was identified by screening existing data sources. The final siting report was completed this year and a meeting to brief stakeholders was held. We also conducted field support for monitoring of the artificial reef installed off Boston Harbor as a component of the 2003-2008 HubLine Mitigation and Restoration Program.

Climate Change Project

The Climate Change Project was created this year with the goal of establishing a coherent approach to examining issues surrounding climate change within *MarineFisheries*.This past year, the Project represented *MarineFisheries* on the Climate Change Task Force, providing recommendations to other state agencies regarding potential impacts and adaptation strategies in the face of climate change. The project also created goals, objectives, and actions for the coming year. They are: 1) establishing a website to describe *MarineFisheries* data that are relevant to climate change; 2) gaining expertise in climate change issues and representing the agency at climate-related meetings as needed; 3) identifying issues that are a priority for *MarineFisheries* relevant to climate change; and 4) promoting research on those priorities.

Other Activities

Offshore Wind Energy

There has been considerable focus on the development of offshore wind energy in the past year. The Habitat Program has provided support and information to EoEEA as well as to the Bureau of Offshore Energy Management, Regulation, and Enforcement by participating in the Massachusetts Renewable Energy Task Force.

Outreach & Peer Review

Habitat Program staff provided scientific peer review for grants and manuscripts submitted to MIT SeaGrant, Estuaries and Coasts, Environmental Biology of Fishes, Journal of Experimental Marine Biology and Ecology, Journal of Fish Biology, Marine Ecology Progress Series, and Methods in Ecology and Evolution. Fisheries Habitat Program staff continued its tradition of participating in a variety of outreach events, such as the New Bedford Working Waterfront Festival. We also organized presentations at the Women in Science and Engineering event and gave presentations at local schools.

Publications

John Logan co-authored the article “Complex migration routes of Atlantic bluefin tuna question current population structure paradigm” in *Canadian Journal of Fisheries and Aquatic Sciences*. Kathryn Ford and Tay Evans co-authored the article “Successful eelgrass restoration in a formerly eutrophic estuary points towards the need for a watershed approach to future management and mitigation of eelgrass loss” in *Estuaries and Coasts*. John Logan co-authored the articles “Stable isotope dynamics in elasmobranch fishes” and “Reply to Hussey *et al*.: The requirement for accurate diet-tissue discrimination factors for interpreting stable isotopes in sharks” in *Hydrobiologia*. Kathryn Ford co-authored the article “Understanding climate impacts on recruitment and spatial dynamics of Atlantic cod in the Gulf of Maine: Integration of observations and modeling” in *Progress in Oceanography*.

FISHERIES BIOLOGY SECTION

Dr. Michael Armstrong, Section Leader

Fish Biology Program

Personnel

Dr. Gary Nelson, Program Manager
William Hoffman, Senior Biologist
Brian Kelly, Biologist
Brad Schondelmeier, Assistant Biologist
Micah Dean, Senior Biologist
Scott Elzey, Biologist
Kimberly Trull, Ageing Technician
Kate L'Heureux, Ageing Technician
Jennifer Stritzel-Thomson, Assistant Biologist

Overview

The objectives of the Fish Biology Program are to collect, process, and analyze biological data on recreationally- and commercially-important fishes needed for effective, science-based management of Massachusetts' fisheries resources. Biological data collected from harvested and released fishes include age structures (i.e., scales, otoliths, vertebrae), length frequencies, maturity stages, and bycatch levels. All data are used in stock assessments to determine the status of those resources. In addition, information on catch and effort of recreational anglers are collected via volunteer surveys. Special research projects are also conducted to address specific management actions.

Age and Growth Project

In 2010, two new ageing technicians were added to the Age and Growth Project staff. After the laboratory set-up was completed, staff cleaned, processed, and aged hard-part structures from recreational and commercial samples of bluefish, river herring (alewife and blueback herring), American shad, smelt, striped bass, tautog, and white perch. Table 4 shows the number of structures processed and aged.

Table 4. Samples processed for age in 2010

Species	Structure	Process	Quantity (Fish)	Sample Dates
Bluefish	Otoliths	Sectioned, Aged	70	2009-2010
River Herring	Scales	Cleaned, Mounted, Aged	1,635	2010
River Herring	Otoliths	Aged	112	2010
Shad	Scales, Vertebrae, Opercula, Otoliths	Extracted, Processed, Aged	632	2008-2010
Smelt	Scales	Reread (QC and training)	1,432	2006-2008
Smelt	Scales	Reference Collection Creation	405	2006-2009
Smelt	Otoliths	OTC Mark Check	68	2010
Smelt	Scales	Mounted, Aged	686	2010
Striped Bass	Scales	Cleaned, Pressed	1,218	2009-2010
Striped Bass	Otoliths	Sectioned/Aged	123	2010
Tautog	Opercula	Reference Collection Creation	500	1995-2010
Tautog	Opercula	Cleaned, Aged	270	2010
White Perch	Scales	Cleaned, Pressed	199	2010
White Perch	Scales	Aged	85	2008

Quality assurance/quality control (QA/QC) procedures for ageing were also developed for several species. These procedures included the creation of reference collections and comparisons of intra- and inter-reader errors prior to and after ageing. Many procedures follow those developed by the age and growth laboratory of the National Marine Fisheries Service in Woods Hole.

Fisheries Dependent Sampling Project

The Fisheries Dependent Sampling Project is responsible for the oversight and sampling of commercial and recreational fisheries, implementation of fish biology studies, and support to other projects and senior staff.

Commercial and Recreational Fisheries Sampling

MarineFisheries conducts at-sea and shore-side (port) sampling of commercial fisheries in order to document fishery performance and collect biological samples for stock assessment research. Recreational fisheries data are collected primarily through NMFS' recreational sampling survey. Data collected strengthen *MarineFisheries'* participation on – and contributions to – the fishery management councils and ASMFC. Sampling efforts in which Project staff participated during 2010 are shown in Table 5. Units for at-sea sampling are shown as number of "sea days" and port sampling are shown as number of sampling events, or trips, made to intercept vessels or dealers where information was successfully collected.

Table 5. Participation by Fisheries Dependent Sampling Project staff in fisheries-dependent and other sampling projects during 2010

At-Sea Sampling (Sea Days)	North Shore	South Shore
Coastal Lobster (commercial)	29	30
Marine Recreational Information Program (recreational)	19	
Resource Assessment Project	20	3
Acoustic Tagging Project	102	
Norbait Longline Sampling	5	
Haddock Longline (commercial)	6	
Northern Shrimp (commercial)	1	
Squid Sampling (commercial)		5
Striped Bass Tagging		2
Summer Flounder (commercial)		5
Whiting Raised-Footrope (commercial)		3
Smelt Fyke Net		2
National Coastal Containment Assessment	6	
Winter Flounder Young-of-Year		4
Total	**188**	**54**
Port Sampling (Intercepts)	**North Shore**	**South Shore**
Striped Bass Market Sample (commercial)	12	
Atlantic Herring Bycatch Study (commercial)	55	3
Large Cod (commercial)	3	
Herring GSI	6	
Northern Shrimp (commercial)	6	
Wolffish (commercial)	6	
Menhaden (commercial)		4
Spiny Dogfish		8
Total	**88**	**15**

Small Pelagic Fishery Dockside Monitoring and Avoidance System

MarineFisheries has been conducting portside sampling of the herring and mackerel fisheries since 2008 with the goal of quantifying catch composition and verifying landings. The objective of the project is to collect biological information and samples to assist stock assessments and supply information and support for fisheries management. In 2010, 50 trips were sampled, representing 24% of the landings by the fishery.

Beginning October 1, the Fisheries Dependent Sampling Project began implementing the River Herring Bycatch Avoidance Study. Funding for the study was through a grant received by the National Fish and Wildlife Federation and includes a collaborative partnership with SMAST and the commercial fishing organization Sustainable Fisheries Coalition. The goal of the study is to develop a bycatch avoidance incentive system to minimize the bycatch of

river herring in the small pelagic mid-water trawl fishery. Through this grant, the Project increased port sampling levels to cover 54% of the trips in 2010.

Special Fisheries Research Projects

Cod Conservation Zone (CCZ) Investigations

Working in collaboration with SMAST, studies using acoustic telemetry, data storage tags, traditional tags, and underwater video were implemented to help understand the fine-scale population structure of inshore Atlantic cod and their behavior and movement patterns. Staff tagged 55 cod with Vemco acoustic transmitters and Starr-Oddi Data Storage Tags (DST), tagged 81 cod with DST tags, and tagged 841 cod with traditional t-bar tags. Data collection is also ongoing in the Winter CCZ to document the spatiotemporal and stock demographics of cod in the zone. Hydroacoustic surveys of cod spawning aggregations in the Spring and Winter CCZs were also conducted using an acoustic array consisting of 28 Vemco receivers. The results of these efforts will provide managers with the required information to help support the management and protection of spawning aggregations in state jurisdictional waters and, among other things, provide researchers with insight on cod reproductive behavior.

A draft manuscript on cod behavior entitled “Disruption of an Atlantic cod (*Gadus morhua*) spawning aggregation as a result of the opening of a directed gillnet fishery” was prepared for publication submittal.

Striped Bass Research Project

Massachusetts is home to the one of the largest recreational striped bass fisheries in the country. High population abundance of striped bass, the diversity of the Commonwealth's nearshore habitat, and many sources of food for stripers are major factors contributing to the success of this fishery. Without a doubt, striped bass are the backbone of our recreational industry and provide enjoyment to hundreds of thousands of recreational anglers each year. Accordingly, we give this important resource a high level of attention by conducting many special investigations and monitoring programs designed to support the regional management process.

Survival Tagging Study

MarineFisheries joined the Striped Bass Cooperative State-Federal Coast-wide Tagging Study in 1991. The study's primary objective has been to develop an integrated database of tag releases and recoveries that will provide current information related to striped bass mortality and migration rates. During 2010, the Striped Bass Research Project conducted 13 trips aboard contracted vessels, tagging a total of 329 striped bass. Staff, volunteer anglers, and vessel captains were coordinated via daily phone and e-mails for all trips. Trip data were entered into appropriate databases.

Market Sampling

Continued and improved monitoring of the age, size, and sex composition of the commercial harvest of striped bass is indispensable for identifying effective management and for

substantiating estimates of mortality derived from fishery-independent sources. The objective of this project is to generate a time series database of biological characteristics of Massachusetts's commercial striped bass landings. During 2010, the Striped Bass Research Project conducted 19 market sampling trips, collecting length, weight, and age structures (scales) from 608 commercially-caught fish.

Acoustic Tagging Study

The Acoustic Tagging Study includes a two-phase, multi-year effort to provide fisheries managers with information that can be used to enhance evaluations of current fishing mortality and the impact of the current prohibition of recreational fishing in the Federal Exclusive Economic Zone (EEZ). The primary objective of the study is to determine if striped bass located in the EEZ, adjacent to Massachusetts, enter Massachusetts territorial waters. The secondary objectives are to identify the spatiotemporal patterns of local striped bass movements, confirm if the Cape Cod Canal is an important passageway for striped bass migration, and further investigate the temperature and depth preferences of migrating striped bass. During 2010, staff conducted acoustic tagging of 50 striped bass in the EEZ and 12 striped bass in Merrimac River and Salem Sound. In addition a 54 receiver acoustic array that ranged from Cape Ann to Cape Cod was designed, deployed, and maintained (Figure 7). Bill Hoffman submitted a report on the acoustic telemetry study to the ASMFC's Striped Bass Technical Committee.

Figure 7. *MarineFisheries* Fish Biology Program staff preparing to set hydro-acoustic receivers in Massachusetts Bay

Volunteer Recreational Angler Data Collection Program

Continued and improved monitoring of the age, size, and sex composition of the recreational harvest and discards of striped bass is indispensable for effective management and for substantiating estimates of mortality derived from fishery-independent sources. The objective of this project is to generate a time series database of biological characteristics of Massachusetts's striped bass recreational harvest and discards.

The Sportfish Angler Data Collection program continued in 2010. Assistant Biologist Jennifer Stritzel-Thomson compiled and analyzed angler data on striped bass, and developed a report which was mailed to participating volunteer anglers. Over 1,560 length/age samples were collected by participating anglers.

The web-based *eLogbook* continued in 2010. Forty-nine anglers registered and entered over 2,000 length records on striped bass and 22 other species of marine fish.

A carcass collection project was conducted in 2010 to obtain otolith samples from striped bass for ageing studies. Volunteer recreational anglers were asked to keep and store filleted carcasses in freezers placed at three sites along the MA coast. Volunteers donated over 135 carcasses.

Other Activities

Sportfisheries Technical Assistance

Fish Biology Program staff provide technical expertise to other governmental organizations, private groups, and individuals with concerns about marine fisheries and serve on technical and advisory committees to support management efforts of important marine species. In 2010, Gary Nelson served as the Massachusetts representative to the ASMFC's striped bass tagging, technical and stock assessment sub-committees, and the river herring stock assessment sub-committee; Micah Dean served on the ASMFC menhaden technical committee. In addition, staff developed a Microsoft Access application for Massachusetts community watershed groups to analyze visual count data of river herring passage.

Publications

Gary Nelson contributed a monitoring report of Massachusetts' 2009 striped bass fishery to the Division's Technical Report Series.

Gary Nelson, Michael Armstrong, and Jennifer Stritzel-Thomson co-authored "Thermal habitat of striped bass (*Morone saxatilis*) in coastal waters of northern Massachusetts, USA, during summer" published in *Fisheries Oceanography*. Gary Nelson contributed a review of the book "Handbook of Marine Fisheries Conservation and Management" to the journal *Fisheries*.

Assessment and Survey Program

Personnel

Steven J. Correia, Program Manager

Resource Assessment Project
Jeremy King, Senior Biologist
Matthew Camisa, Biologist
Vincent Manfredi, Biologist

Invertebrate Fisheries Project
Robert Glenn, Project Leader
Vin Malkoski, Senior Biologist
Derek Perry, Biologist
Tracy Pugh, Biologist
Kelly Whitmore, Biologist
Steve Wilcox, Assistant Biologist
Mike Trainor, Seasonal Fisheries Technician
Jillian Weber, Seasonal Fisheries Technician

Protected Species Project
Erin Burke, Protected Species Specialist

Scientific Diving Project
Holly Martel Bourbon, Diving Safety Officer

Overview

The Assessment and Survey Program includes the Resource Assessment Project, Invertebrate Fisheries Project, Protected Species Project, and Scientific Diving Project.

The **Resource Assessment Project** monitors the distribution, relative abundance, and size composition of marine fish and invertebrates in Massachusetts' territorial waters by conducting annual surveys utilizing consistent protocols. The year 2010 marked the completion of the 33rd consecutive annual spring and fall statewide trawl surveys and the 35th consecutive annual seine survey conducted in Cape Cod estuaries. Data provided by the surveys are used in assessments of numerous regional fish stocks. In addition, the surveys inform fishery management decisions in state waters and contribute to evaluation of coastal alteration projects.

The **Invertebrate Fisheries Project** focuses on research and monitoring of American lobster, horseshoe crab, and northern shrimp to provide pertinent data to enhance management. Fishery-dependent and fishery-independent surveys are conducted to characterize the populations of, and the fisheries for, these valuable species. Ongoing tasks include research grant writing and administering and participation in ASMFC fisheries management and stock assessment meetings for key invertebrate species.

The **Protected Species Project** is involved in a variety of activities related to the conservation and management of protected species in Massachusetts waters. This covers all

efforts of the Large Whale Conservation Program, including the right whale surveillance program, acoustic monitoring of right whales, and large whale disentanglement. In addition, *MarineFisheries* oversees and participates in work on other protected species, such as harbor porpoise and sea turtles. In 2010, these activities covered a range of issues such as the sea turtle disentanglement network, ghost gear removal, acoustic validation of right whale calls, the Massachusetts Lobster labeling and promotion campaign, participation in three federal Take Reduction Teams, general grant management, and providing protected species guidance to *MarineFisheries* staff.

The **Scientific Diving Project** is responsible for the safe management of the scientific diving activities conducted by *MarineFisheries*. Currently operated in accordance with the Occupational Safety and Health Administration's scientific diving exemption, formal standards for training and dive operations afford *MarineFisheries'* divers better protection from accidental injury and/or illness. Since the Dive Program's inception, diving within *MarineFisheries* has markedly increased and contemporary diving and risk management procedures are necessary to accommodate this demand.

Resource Assessment Project

2010 Trawl Survey

Data Collection: The 33rd spring and fall surveys were accomplished in 2010 aboard the R/V Gloria Michelle. During the spring survey, 103 stations were completed in 16 consecutive days from 3-18 May. During the fall survey, 92 stations were sampled from 7-23 September (Figure 8). A total of 109 different species of fish and invertebrates were weighed, counted, and measured during the 2010 trawl surveys. To aid cooperative fisheries assessments, over 2,000 scale/otolith samples, and sex and maturity observations were taken from Atlantic cod, haddock, summer flounder, yellowtail flounder, winter flounder, windowpane flounder, black sea bass, and scup on the spring survey. More than 1,350 additional samples were collected during the 2010 fall survey.

In 2010, the R/V Gloria Michelle was out-fitted with three Fisheries Scientific Computer System (FSCS) sampling stations, each equipped with a touch screen monitor, electronic measuring board, electronic scale, label printer, and barcode scanner. All the hardware is wired to a rack of computers below decks loaded with the NOAA-developed FSCS software and an Oracle database storing all data records. The move to digital data collection reduced opportunities for data entry errors, results in immediate data availability for auditing, and eliminates the need for post-survey data entry.

Data Interpretation and Presentation: Early in 2010 a manuscript titled "Massachusetts Division of Marine Fisheries Trawl Survey Effort, Lists of Species Recorded, and Bottom Temperature Trends, 1978 – 2007", was finalized and published in the Division's Technical Report Series. This report provides data users with necessary details of survey data collection efforts to assist with interpretation.

Steven Correia and project personnel prepared and presented an analysis of catch distributions in the Gulf of Maine portion of the trawl survey area at the Cape Cod Bay Symposium of the New England Estuarine Research Society's annual fall meeting. The presentation was a lead into subsequent analyses which will be pursued in 2011.

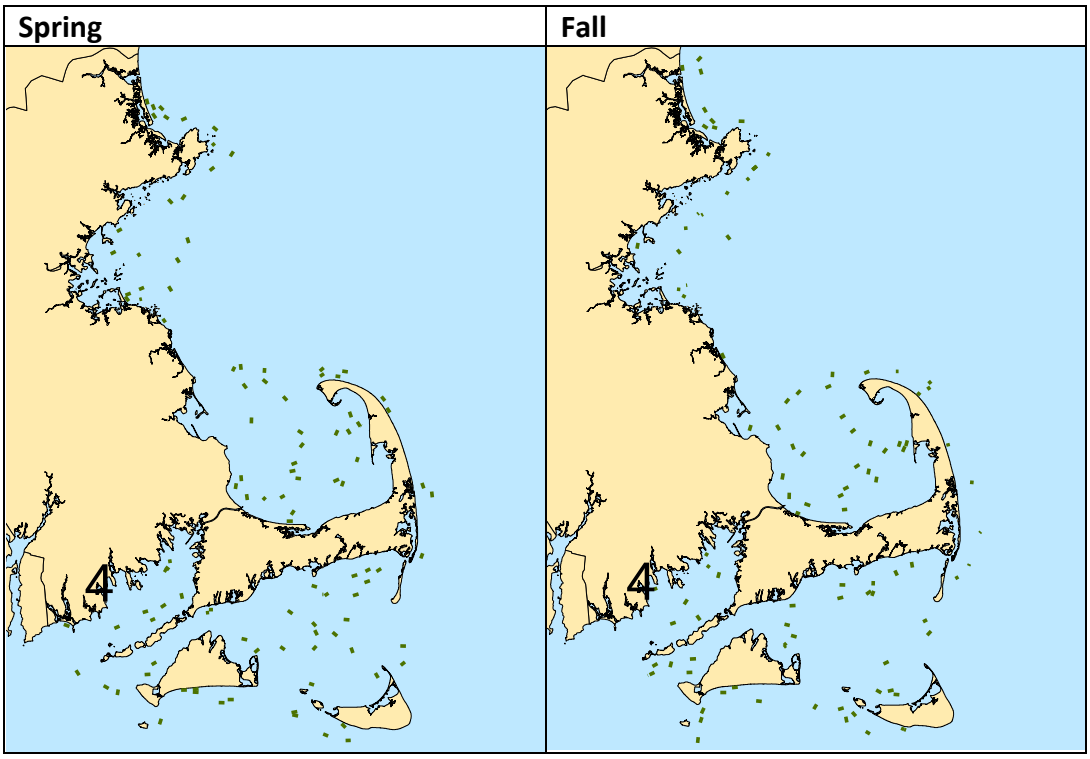


Figure 8. 2010 spring and fall trawl survey station locations

A collection of over 1,800 survey photos recording trawl survey experiences for the past 33 years was entered into a searchable digital archive for use by all *MarineFisheries* staff.

A crew from the British Broadcasting Company (BBC) spent part of one day filming survey operations on the spring survey for an episode of BBC Horizons which aired on the BBC in fall 2010.

A summary of *MarineFisheries* seine and trawl survey methodologies and database structures was presented at a coast-wide meeting of survey representatives gathered to plan an integrative geodatabase utilizing all available survey data sources to improve identification of essential fish habitat.

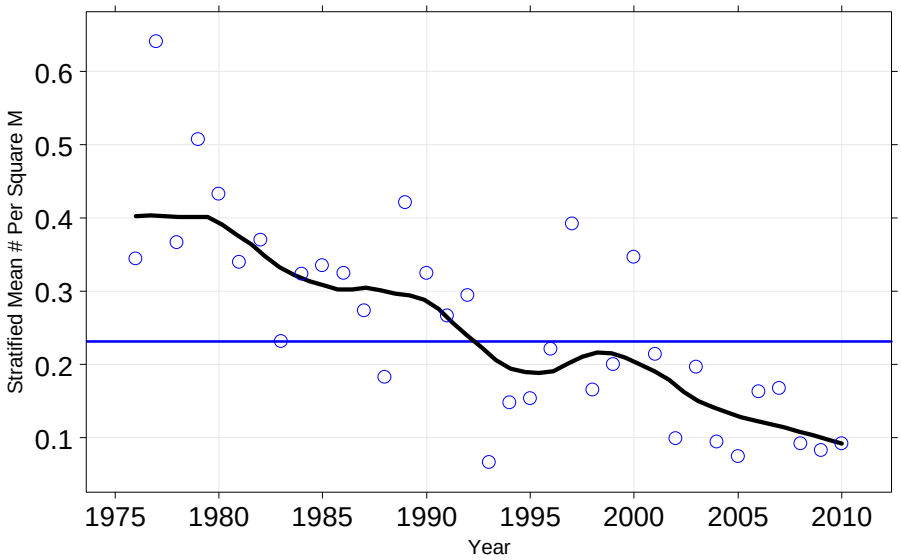
2010 Seine Survey

The 35th Nantucket Sound Estuarine Winter Flounder Young-of-Year (YOY) Seine Survey was conducted from 21 June – 9 July, 2010. The primary objective of this survey is to provide a winter flounder YOY abundance index for the Southern New England Stock. All commercially and recreationally-important finfish and invertebrates were counted. All species not counted were noted for presence. The pooled (all estuaries combined) winter flounder YOY index remained very low (0.092 YOY / m^2) in 2010, completing a decade of indices below the time series median (Figure 9). A record 37 % of hauls produced no winter flounder.

The YOY summer flounder index dropped to the median value in 2010 following five of the highest values in the timeseries in the past decade (Figure 10).

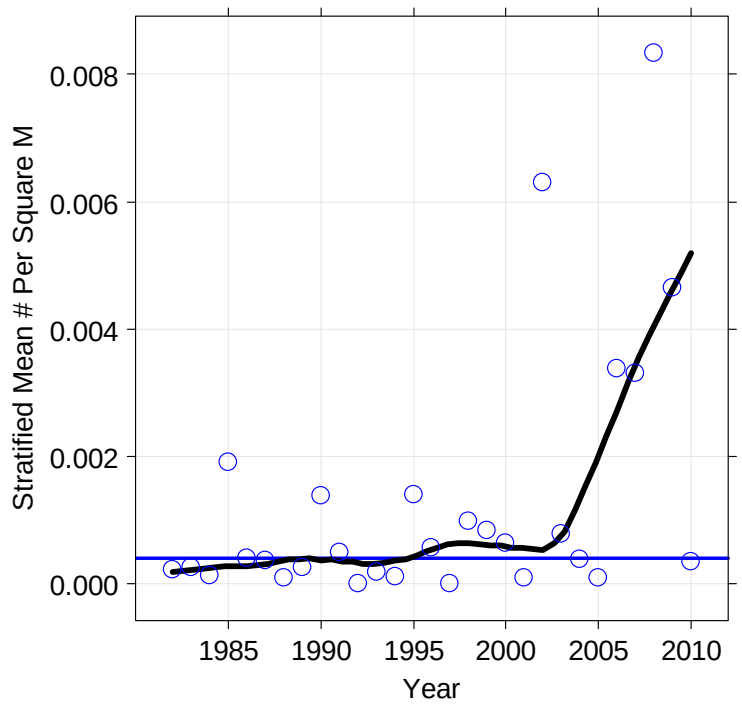
A total of 40 species were encountered in seine hauls. Striped searobin catches in 2010 far exceeded any previous seine survey results corroborating record highs counted in the past

two spring trawl surveys. In addition, northern kingfish counts were recorded at the second highest level in the seine survey.



Black line: Loess smoothed index, span=0.3, degree=1. Blue Line = Timeseries Median.

Figure 9. Abundance index for YOY winter flounder, *Pseudopleuronectes americanus,* in Southern New England from the seine survey, 1976-2010



Black line: Loess smoothed index, span=0.3, degree=1. Blue Line = Timeseries Median.

Figure 10. Abundance index for YOY Summer Flounder, *Paralichthys dentatus*, from the seine survey, 1982-2010

Assessment and Fisheries Management Support

Survey data and/or summary graphics were provided to assessment scientists in support of ASMFC assessments and/or compliance reports for numerous ASMFC-managed species including: tautog, black sea bass, summer flounder, winter flounder, horseshoe crab, lobster, spiny dogfish and alewife.

Survey data on redfish were provided to fisheries scientists investigating the potential of a directed redfish fishery in the Gulf of Maine. Red hake and silver hake data were supplied to NMFS staff working on upcoming regional assessments.

Other data requests were filled to support studies on smooth dogfish, lobster, whelks, coastal ecology, and coastal fish assemblages.

Invertebrate Fisheries Project

Commercial Lobster Trap Sampling

The 30th year of Commercial Lobster Trap Sampling was completed. This is an ongoing cooperative effort conducted with Massachusetts commercial lobster fishermen dating back to 1981. A total of 87 trips were conducted in 2010, during which 47,478 lobsters were sampled from 15,896 trap hauls.

Data from the commercial trap sampling program contributed to *MarineFisheries*' bi-annual lobster status of the stock report, and were provided to the ASMFC.

Ventless Lobster Trap Survey

The 5th year of the Coast-wide Ventless Trap Survey was completed within the territorial waters of Massachusetts using a random stratified survey design with depth as the strata classification. Each year, 60 sampling stations in NMFS Area 514 and 24 stations in NMFS Area 538 (Figure 11) are randomly selected and are sampled twice monthly from June through September. This survey design allows biologists to develop more precise estimates of lobster relative abundance and to adequately characterize the size distribution of lobsters in coastal waters. In 2010, a total of 56 sampling trips were completed by *MarineFisheries* staff and more than 17,409 lobsters were sampled from 4,032 trap hauls. Results of data analysis were made available to the ASMFC.

The ventless trap survey is a multi-state cooperative effort between state fisheries agencies and commercial lobstermen and takes place using standardized sampling methods in coastal waters from Maine to New York.

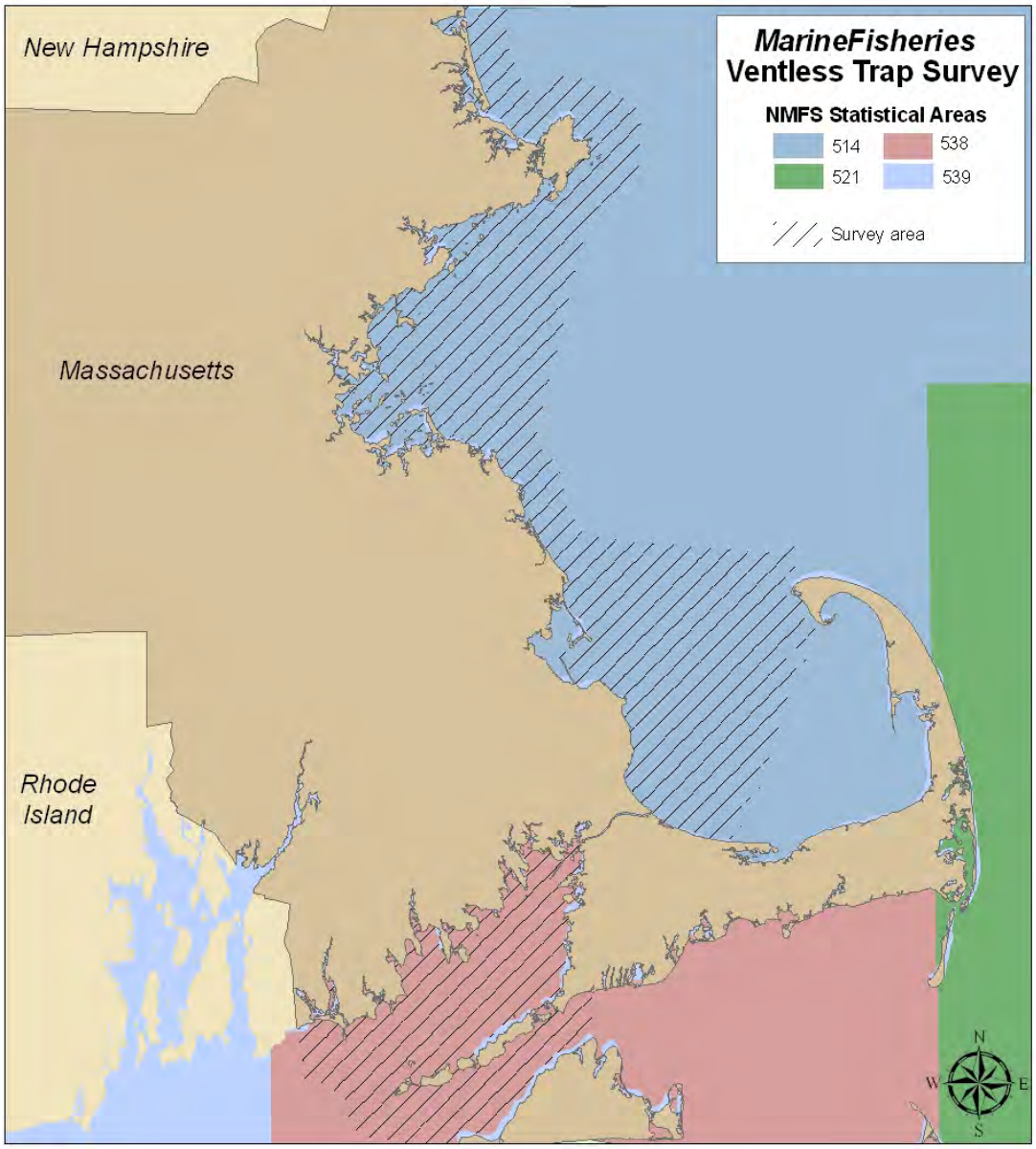


Figure 11. *MarineFisheries* Ventless Trap Survey areas inside NMFS statistical areas 514 and 538

Lobster Stock Assessment

Staff participated in multiple ASMFC Lobster Technical Committee meetings which focused on the Southern New England lobster stock collapse. The Southern New England stock is at record low levels of abundance with moderate to low exploitation rates and is characterized as being in "poor" condition. The decline in the Southern New England stock is being attributed to prolonged high levels of commercial exploitation in combination with increased natural mortality associated with changing habitat conditions, namely, increased temperature. Staff played a key role in drafting a report to the ASMFC Lobster Management Board describing recruitment failure in this stock and the impediments to rebuilding it.

Annual Early-Benthic-Phase Lobster Suction Sampling

The 16th year of the Annual Early Benthic Phase Lobster Suction Sampling Program was completed. In addition to the 17 historical coastal sites spanning Buzzards Bay, Cape Cod Bay, and Massachusetts Bay, three new stations were surveyed. Two of these were off of Cape Ann, a region that had previously been unrepresented in the survey. The third site was added in Buzzards Bay, which as part of LMA 2 has been experiencing recruitment failure in recent years. The new Buzzards Bay station was added to increase spatial coverage of the Bay and to better monitor recruitment signals in southern New England. This year's survey was conducted over 10 days from mid-August to late-September. For the third year in a row, all survey regions were below their time series means for YOY lobsters. All regions showed slight improvement from 2009 with the exception of Buzzards Bay.

Lobster Settlement Dynamics

In early 2009, the Invertebrate Fisheries Project initiated a Commercial Fisheries Research Foundation-funded study, entitled "Examining settlement dynamics of postlarval American lobster (*Homarus americanus*) in Lobster Management Area 2". This study was lead by *MarineFisheries* staff with participation from Rhode Island Department of Environmental Management, NOAA Fisheries, Bigelow Laboratories, Rhode Island Lobstermen's Association, and Massachusetts Lobstermen's Association.

For this multi-faceted study we set out 224 postlarval lobster settlement collectors (Figure 14) in coastal waters from Buzzards Bay to Block Island from June to October 2009, in order to determine geographic distribution of settlement in LMA 2. Between 2009 and 2010, we also deployed 44 satellite-tracked drifters in upper and lower Buzzards Bay, Vineyard Sound, Rhode Island Sound, and Narragansett Bay to observe larval transport pathways. Total distance logged by drifters was over 17,000 kilometers and durations varied from a few hours to over 100 days. Air-lift sampling was conducted to evaluate habitat quality in areas receiving larval supply, as indicated by the drifter tracks.

Figure 12. Hauling back settlement collectors

Drifter tracks consistently indicated that larvae released from eggs outside the southern entrance of Buzzards Bay, where many egg-bearing females now concentrate, were unlikely to be carried into the Bay, thus little settlement was expected there. In addition, no YOY settlement was observed in the collectors placed in Buzzards Bay. Preliminary findings were presented to the ASMFC Lobster Technical committee in March 2010 and have been incorporated in discussions on the recruitment failure and settlement decline in Southern New England. Data collected from this project

have proved valuable in providing context to the observed declines in YOY lobster settlement in the eastern portion of the SNE lobster stock.

In 2010, *MarineFisheries* expanded the settlement dynamics research effort to the Massachusetts portion of the Gulf of Maine. A total of 208 settlement collectors were set in shallow (<10 m) waters, paired at 1.9 km intervals along the coast from Cape Ann to Cape Cod Bay. Geographic trends in lobster settlement were compared by region and to annual airlift sampling data. A total of 228 lobsters were observed, of which 25 were YOY. As with the SNE project, we identified locations where female late-stage ovigerous females concentrate and we released satellite-tracked drifters when and where egg-release was expected. We tracked the drifters and identified locations along the coast likely to receive larvae. Data compiled from the drifter tracks, settlement collectors, and air-lift sampling will be used to identify settlement patterns in Massachusetts and Cape Cod Bays.

Lobster Reproduction Studies

Staff member Tracy Pugh has been working collaboratively with the University of New Hampshire (UNH) to conduct research on lobster reproduction as part of her PhD dissertation. Working with UNH professor Dr. Win Watson, Ms. Pugh is conducting field and laboratory work that examines how male lobsters may be limited in their ability to supply sperm to females, with the end goal being to account for male contributions to reproductive success in the stock assessment process.

As a component of this collaboration, a grant from the Commercial Fisheries Research Foundation was awarded to UNH (W. Watson, P.I., *MarineFisheries* contributors R. Glenn and T. Pugh), for which Pugh is responsible for conducting data collection and analysis. The goal of the two-year grant, entitled "*The Buzzards Bay lobster resource: Are changes in reproduction having a negative impact on the fishery?*" is to determine if relatively recent changes in lobster reproduction dynamics have altered the reproductive potential of this valuable marine resource. Work has included at-sea sampling, tagging, and a review of existing long-term data sets. Approximately 9,222 lobsters were observed during the 2009 and 2010 sampling seasons; 1,942 of which were tagged and released in 2009. The tagging return rate has been relatively low, with only 6% of tagged lobsters recaptured. A total 3,354 female lobsters ranging in size from 60 to 103 mm were sampled to determine if they had mated successfully.

Ghost Gear Study

In 2010, staff began work on a study of derelict lobster fishing gear. This two-year study was made possible by a $145,000 research grant from the National Fish and Wildlife Foundation and NOAA Marine Debris Program. Despite the large scale and high value of the American lobster fishery, little information exists on the number of lobster pots annually lost or how long these "ghost pots" continue to fish. Legally required degradable escape panels are believed to reduce capture and mortality of lobsters; however, if the ghost pots continue to fish for even a short-term, there may be a substantial loss of yield to the lobster fishery. The catch lost to ghost fishing may also undermine our ability to fully model lobster population dynamics.

In May of 2010, *MarineFisheries* personnel set and "abandoned" two sets of lobster pots near Manomet Point, Cape Cod Bay and Penikese Island, Buzzards Bay. A third set was deployed at each site in November of 2010. *MarineFisheries* SCUBA divers surveyed the gear a total of 28 days from May through December of 2010, making over 120 dives. Preliminary results show that ghost pots could be a significant source of undocumented mortality of both lobster and bycatch species. Of the original gear set in May of 2010, 88% of the pots were still actively fishing seven months later. This study is scheduled to continue through December 2011.

Northern Shrimp Survey and Assessment

Staff participated in ASMFC Northern Shrimp Technical Committee meetings to generate the 2010 ASMFC Northern Shrimp Stock Assessment.

In July, project staff participated on one-week legs of the annual northern shrimp assessment survey conducted throughout the Gulf of Maine aboard the R/V Gloria Michelle. Results of the 2010 assessment survey indicated that abundance of the 2006 year class (assumed five-year old females) was well below average when compared with previous year classes. As result, the ASMFC Northern Shrimp Technical Committee expected that 2010/2011 commercial catches would be comprised mostly of four-year old (2007 year class) versus five-year old female shrimp. These shrimp would be smaller on average than those harvested over the past few seasons.

Horseshoe Crab Monitoring

The annual volunteer-based survey of horseshoe crab spawning beaches was completed. The year 2010 was the first in which surveys were conducted in conjunction with 5-day harvest closures around each new and full moon; counts were to be analyzed along with 2010 harvester landings data to evaluate the effectiveness of the new management measures.

Dealer port sampling of horseshoe crabs continued in 2010 and a total of 1,198 beach-harvested crabs were sampled at two dealerships and at the Associates of Cape Cod on four trips. In addition, prosomal width measurements were obtained from 433 dragger-caught crabs at one dealership. Data from 2009 were summarized and included in the ASMFC compliance report.

Project staff initiated a Sea Grant-funded telemetry study to assess the movement patterns and spawning site fidelity of female horseshoe crabs. Twenty-two coded receivers were deployed in buoyed moorings during May 2010 in the Stage Harbor-Monomoy area of Nantucket Sound (Figure 13).

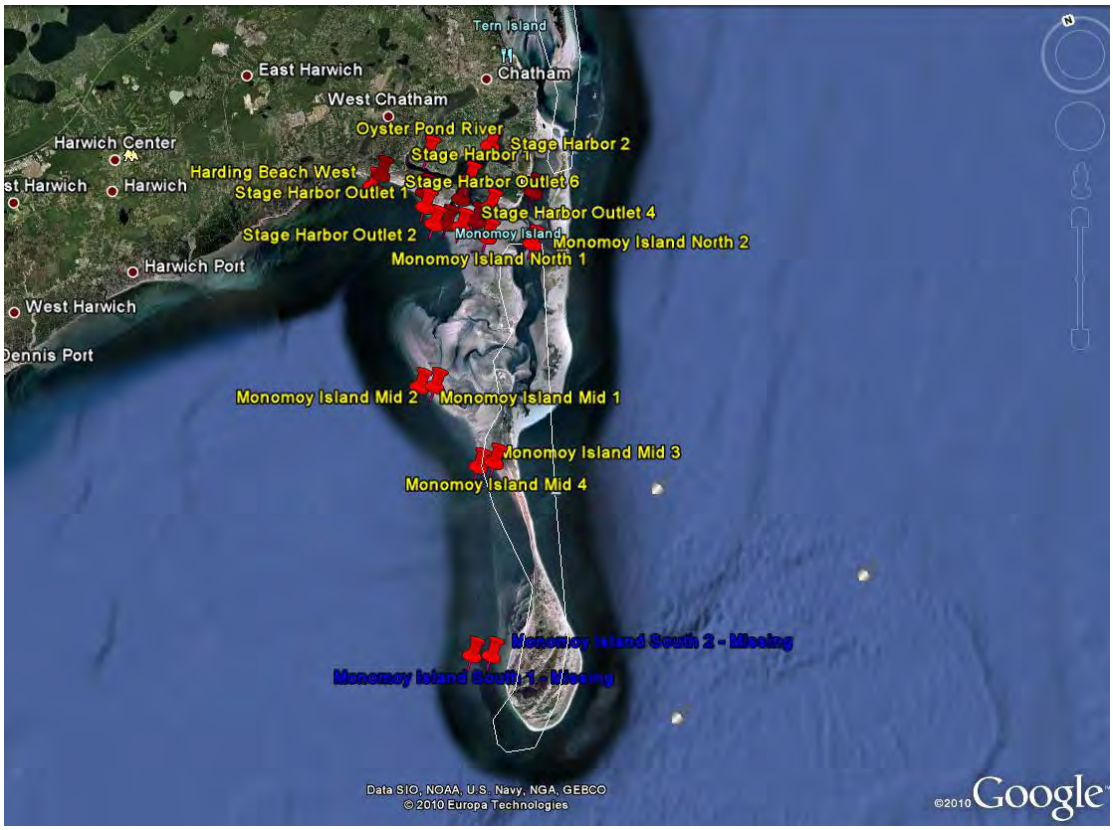


Figure 13. Receiver locations off Stage Harbor and Monomoy Island, May–November 2010

Seventy-five horseshoe crabs (66 female and nine male) were tagged with Vemco V13 transmitter tags on spawning beaches in the area of Stage Harbor and Monomoy Island. The tags were attached to the top of the carapace using a system of adhesive Velcro and marine 2-part epoxy (Figure 14). A uniquely numbered U.S. Fish and Wildlife Service (USFWS) button tag was also affixed and the crabs were released in the area of capture.

The fixed receivers were retrieved and downloaded in August and again in early September when the outer moorings were removed from the water in anticipation of Hurricane Earl. The majority of the receivers (16) were removed from the water for the winter in late November. Three were lost, likely buried as the result of sand movement, and three were left in the water inside Stage Harbor. The receiver moorings were planned for redeployment in late March or early April of 2011 in advance of the beach spawning season.

Figure 14. Horseshoe crab with transmitter tag

Bottom Temperature Monitoring

Data from 10 permanent bottom-temperature monitoring stations were collected in 2010. Divers located and replaced temperature monitors at each station. The stations are located throughout the state from Cape Ann to southern Buzzards Bay and located in water depths from 5 to over 30 meters. Data from these monitors are valuable in detecting environmental change in Massachusetts' waters. Many of the stations have collected bi-hourly temperature readings for over 20 years. Temperature data from Southern New England has indicated a warming trend in the area and has helped explain changes in population dynamics of some cold-water species, including American lobster.

Boston Harbor Artificial Reef Monitoring

The fifth year of annual sampling was completed on the *MarineFisheries*-constructed HubLine artificial reef. Monitoring components included transect surveys and suction sampling on both the artificial reef and comparison natural reef sites. Transect surveys were conducted in July and August using quadrat and swath bar sampling techniques. Results indicated that the natural reef remains more diverse than the cobble artificial reef; however, the cobble has provided habitat for a variety of life history phases of American lobster, other crustaceans, and finfish. We have found that there are differences in species' preferences for particular rock sizes, information that may be used in developing guidance for future mitigation efforts.

Protected Species Project

Cape Cod Bay Right Whale Surveillance Program

In 2010, the Cape Cod Bay Right Whale Surveillance Program was conducted through a *MarineFisheries* contract with the Provincetown Center for Coastal Studies (PCCS) funded by NOAA Fisheries. The program carried out aerial surveillance and habitat monitoring of right whales in Cape Cod Bay (CCB) Critical Habitat and adjacent waters.

The 4-year trend of extraordinary abundance of right whales in CCB continued during 2010. A total of 199 individual right whales were documented in CCB and adjacent areas – approximately 46% of the known population (436 right whales).

However, a portion of whales seen in 2010 (17%) were observed only east of Cape Cod. The number of individuals seen there increased threefold between 2009 and 2010 even though the same amount of survey effort took place in both years. The habitat monitoring program, which collects data on the relationship between right whales and their food resource in CCB, found zooplankton densities in 2010 to be relatively low and not following typical patterns. This could have resulted in the high number of whales feeding east of Cape Cod.

Large Whale Disentanglement Network

In July 2010, administration of the large whale disentanglement effort in Massachusetts shifted to *MarineFisheries* through the Right Whale Conservation Program and a grant from NMFS. Between July and December 2010, there were 10 new reports of humpbacks or right whales carrying gear in our response area, which is approximately a 50 mile radius around

the coast of Massachusetts. Two of these animals were disentangled. In addition, there were sightings of five animals with previously known entanglements – one of which was ultimately disentangled. The Project Leader assisted the PCCS in disentanglement efforts by investigating gear retrieved from entangled animals and coordinating aerial support when needed, such as from planes associated with the *MarineFisheries* shark tagging program.

Right Whale Acoustic Monitoring

In 2010, *MarineFisheries* continued its partnership with Cornell University and Woods Hole Oceanographic Institution to operate a real-time acoustic monitoring system for right whales in Cape Cod Bay. The buoys monitor and report the occurrence of right whale contact calls in near-real time. We deployed two buoys (Race Point and Wellfleet) on January 1, 2010. The first call in the bay was detected on the Wellfleet buoy on January 10, 2010. Over the course of the season, the buoys detected a total of 2,157 right whale calls, with the Wellfleet buoy detecting almost twice as many calls as Race Point. The last call in the bay was detected on the Race Point buoy on May 23, 2010. The overall time frame for call detection is similar for both buoys; however, as expected, the Race Point buoy picked up the last calls of the season as whales left the bay.

Ghost Gear Removal

Staff worked with the Massachusetts Environmental Police to reduce entanglement risk in CCB Right Whale Critical Habitat. Gear locations provided by the PCCS aerial team were analyzed, mapped, and relayed to the Environmental Police for use in gear removal efforts. In addition, the overlap between right whales and fishing gear was mapped and analyzed over the duration of the season to determine if further protective measures were warranted regarding entanglement risk. Strings of multiple pots are legal in the bay during the right whale season if the gear is equipped with the required modifications (e.g., breakaway links, orange flags, sinking groundline); however, single traps and gillnets are not allowed. Gear locations provided by the PCCS aerial surveillance team were used to guide patrol missions in the bay. Gear was checked for violations and pulled if illegal. Approximately 175 non-compliant traps were removed from CCB Critical Habitat from January 1 – May 15, 2010. Fifty percent were single traps, while another 50% were strings of traps, mostly from one individual whose permit was revoked by the Director as a result of an adjudicatory hearing.

Leatherback Sea Turtle Research and Disentanglement

In May 2010, *MarineFisheries* was awarded a three-year NMFS grant to conduct leatherback sea turtle research and a disentanglement program in Massachusetts' waters. Leatherback sea turtles are seasonal visitors to our waters, where they feed on abundant jellyfish, particularly in Cape Cod Bay, Nantucket Sound, and Buzzards Bay. The goal of the project is to increase our understanding of leatherback turtle behavior and habitat-use in Massachusetts and surrounding areas, and to mitigate fishery-related entanglements (Figure 15). *MarineFisheries* has operated the Massachusetts Sea Turtle Disentanglement Program with PCCS since 2005. In recent years, Dr. Molly Lutcavage of the University of Massachusetts has been attaching satellite tags to leatherback turtles around Massachusetts. Now our groups have joined forces to study the behavior and distribution of leatherbacks in Massachusetts waters and to minimize the risk of entanglement. We will

combine a variety of methods to accomplish our goals, including aerial survey, tagging, disentanglement, gear analysis, and outreach.

Figure 15. Entangled leatherback sea turtle (PCCS photo, activities under ESA and Final Rule 50 CFR Part 222)

The Project Leader administers the grant for this program, including contracting and processing invoices. She also assists in collection of entangling gear, inventory and analysis of retrieved gear, identification of the owners and fishery involved, and provides assistance to NMFS in compiling lists of this information. In spring 2010, the Project Leader conducted three training sessions with the Massachusetts Environmental Police and *MarineFisheries* staff about the turtle disentanglement program, disentanglement techniques, and our upcoming research. *MarineFisheries'* work on the overall turtle project in 2010 included disentanglement efforts, gear collection, and analysis; however, due to logistic constraints, we were unable to tag turtles, but will begin doing so in 2011.

Commonwealth Quality Program

In 2010, *MassDAR* launched a new campaign, called Commonwealth Quality, to certify, label, and promote local and sustainable food products. *MarineFisheries* worked closely with *MassDAR* and the Massachusetts Lobstermen's Association to get Massachusetts lobster included as a sector in the program. It is the first wild-caught fishery to join. This new venture will build on previous efforts by *MarineFisheries* to educate consumers about what Massachusetts lobstermen are doing to protect endangered whales. The Project Leader participated in numerous meetings and discussions about how to allow the lobster industry to participate in this program, based on the criteria developed for all participants. In addition, the Project Leader helped the Massachusetts Lobstermen's Association collate lists of regulations and in developing Best Management Practices required for inclusion in the program.

Scientific Diving Project

In 2010, *MarineFisheries* safely conducted over 600 research dives to support on-going research and monitoring programs. Currently, 10 projects are supported by the Project.

Safety, first responder training, and dive training were provided to 16 *Marine Fisheries* Scientific Divers (Figure 16). The Diving Safety Officer (DSO) and Dive Program Coordinator completed required instructor-related training courses. All Dive Program records were maintained and updated for the 2010 year. Current *MarineFisheries* manual standards were updated and promulgated. Routine annual maintenance was completed on all program dive equipment. A comprehensive overhaul and safety inspection of the air fill station was completed.

Figure 16. Diver training includes pool safety dives

In addition to the above, the DSO participated in several collaborative efforts. The DSO has been an active member of the Mystic Aquarium Dive Control Board, worked with the Northeast Reef Environmental Education Foundation, acted as the Association of Dive Program Administrators' secretary and board member, and provided educational programs for local dive shows and schools.

Other Activities

The Program Manager serves as a member of the NEFMC Groundfish, Monkfish, and Atlantic Herring Plan Development Teams. In that role, he generated analyses to support development of Framework 45 and accumulation limits for the Groundfish FMP, Amendments 5 and 6 to the Monkfish FMP, and Amendment 5 to the Atlantic Herring FMP.

During 2010, the Program Manager served as chair of ASMFC Winter Flounder Technical Committee and continued as a member of the ASMFC Atlantic Herring Technical Committee, ASMFC Assessment Science Committee, ACCSP Biological Review Panel, and ACCSP Bycatch Prioritization Panel.

Other *MarineFisheries* projects and SMAST and URI graduate students are assisted on an as-needed basis with development of sampling designs and statistical analyses. Several large projects included analysis of water quality and periphyton data from various stations in three states to identify habitat suitability thresholds and relationships between causal and response factors; a morphometric analysis of tail length and carapace length for American lobster as supporting analysis for a decision to allow processors to possess lobster tail parts; and an analysis of trends in surface water temperatures in New Bedford Harbor for the period 1998-2010.

Recreational and Diadromous Fisheries Program

Personnel

Dr. Gregory B. Skomal, Program Manager

Recreational Fisheries Project
Paul Caruso, Senior Biologist, Project Coordinator
John Boardman, Biologist,
John Chisholm, Biologist
Matt Ayer, Biologist, North Shore
Kelley Dumas, Seasonal Fisheries Technician
Andrea Petrella, Seasonal Fisheries Technician

Large Pelagics Research Project
Dr. Gregory Skomal, Senior Biologist, Project Coordinator
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Diadromous Fish Passage and Restoration Project
Brad Chase, Senior Biologist, Project Coordinator
Edward Clark, Carpenter
Luis Carmo, Laborer

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Overview

The Recreational and Diadromous Fisheries Program includes the Recreational Fisheries Project, the Large Pelagics Research Project, the Diadromous Fish Passage and Restoration Project, and the Anadromous Fish Biology and Management Project.

The purpose of the **Recreational Fisheries Project** is to preserve, enhance and promote the marine recreational fisheries of the Commonwealth. Goals are to conserve key recreational species through science-based management to support local sustainable fisheries; support the recreational fishing community, including local recreational fishing businesses, and educate the Commonwealth's citizens of the features and benefits of local recreational fisheries resources. Project personnel measure abundance, length frequency, and age classes of key finfish populations for input to stock assessments and to design and analyze management options; assess habitat and prey needs of key species; measure harvest and release of key species; promote and enhance recreational fishing access through the purchase and maintenance of access sites; and disseminate information on all aspects of recreational species and fisheries to the public.

Since 1987, the **Large Pelagics Research Project** has been conducting research to enhance our understanding of the ecology, life history, and relative abundance of sharks, tunas, and billfish off the coast of Massachusetts, where extensive recreational fisheries for these species occur. In addition to this research, the goals of the Large Pelagics Research Program are to foster cooperative research, to participate in the state, regional, and federal management process, and to provide public education and technical information on the biology, management, and utilization of highly migratory species.

The **Diadromous Fish Passage and Restoration Project** is coordinated among *MarineFisheries* staff, state and federal agencies, municipalities, and private groups to facilitate, design, and execute restoration projects with the goal of enhancing diadromous fish populations and habitats. In addition, technical assistance and monitoring are provided as needed for individual restoration projects and coastal watersheds.

The **Anadromous Fish Biology and Management Project** is responsible for the management and assessment of the approximately 18 species of diadromous fish stocks of the Commonwealth. Species such as river herring, rainbow smelt, white perch, tomcod, American eel, and American shad are evaluated for stock size, local harvests, stock requirements, age composition, mortality rates, sex ratios, spawning areas, suitable spawning habitat, and restoration potential. Information generated by this work is essential in the development of sound management practices for these important species, whose seasonal abundance provides a ready source of forage and food for other piscivorous species and coastal fishermen.

Recreational Fisheries Project

MRIP For-Hire Sampling Project

Since 1983, recreational fisheries catch and harvest data have been collected along the Atlantic Coast through NMFS' Marine Recreational Information Program (MRIP). *MarineFisheries* is currently managing the "party boat" survey segment of MRIP for Massachusetts waters, training personnel, scheduling trips, logging data, and maintaining equipment. Daily oversight is provided and two wave data review meetings were attended by the project coordinator in 2010.

During 2010, 69 sea sampling trips were completed for a total of 126 sampler days and 1,045 angler intercepts. A year-end summary report was generated.

Recreational Fishing Derby

Project staff administered *MarineFisheries'* Saltwater Fishing Derby. This included regular communications to weigh stations, preparing press releases for derby promotion and announcement of winners, logging of certified weigh-in shops, and tracking of derby standings in a database. Winners were recognized with awards at the annual Worcester Sportsmen's Show.

The catch and release derby component was promoted with outreach materials and press releases. Project personnel created, printed, and distributed promotional minimum size rulers and rule pamphlets.

Recreational Species Research, Assessment, and Management

Policy, Technical Committee, and Stock Assessment Support: Participation on various technical committees of the ASMFC and MAFMC continued. Stock assessment updates were undertaken, presented to managers, and/or reviewed and management options discussed for key recreational species: summer flounder, tautog, scup, bluefish, black sea bass, sturgeon, striped bass, and river herring.

Project personnel drafted potential regional bag, size, and season restrictions for scup. Tautog, bluefish, black sea bass, summer flounder and scup databases of catch, landings, and adult and YOY survey indices were updated, trend analysis performed, and predictive relationships examined. Regulatory updates were communicated to Massachusetts Environmental Police (MEP) officers and *MarineFisheries* licensing staff.

Work continued on the recreational angler registry initiative, including drafting of a Memorandum of Agreement and proposal for registry exemption for Massachusetts for-hire vessels.

Striped Bass Tagging, Age, and Growth: Staff conducted the survival tagging study, and assisted with the acoustic tagging and market sampling of striped bass (see Striped Bass Research Project under Fish Biology Program for more information).

Tautog Age and Growth: *MarineFisheries* started voluntary age and growth sampling of tautog in 1995 and it has continued as a limited sampling program to the present. It has been invaluable in regional stock assessments due to the lack of age sampling by neighboring states in past years.

The 1995 stock assessment of tautog, on which the first interstate FMP was based, used an age-length key developed from Connecticut and Rhode Island data only. This was found unacceptable and improvement in the age-length keys for future assessments was first sought through voluntary participation in age and growth sampling, and second through a 2002 FMP amendment requiring sampling (200 age samples per state per year). The resulting age/length data from Massachusetts is used in coast-wide stock assessments and local assessments for Massachusetts and Rhode Island which allows these two states to manage tautog unilaterally in addition to continuing to contribute to the overall ASMFC assessment and management process.

In 2010, *Marine Fisheries* obtained a total of 252 tautog through directed sea sampling and purchase from commercial fishermen. Opercula were obtained from most all samples, cleaned and read. Age data was entered into the database and a 2010 age-length key created.

Habitat and Access

Access-related work included periodic site monitoring and site improvements to the Craven's Landing Access site. This included the procurement and installation of new fence rails and installation of new signage and fencing. Staff maintained regular communications with the property's neighbors as well as routine contact with law enforcement officers regarding enforcement of the rules. Warning letters were sent to several violators of site rules. The Project recruited and supervised seasonal patrol help, and hired and supervised a contractor to patrol the area for two days per week during the season.

Project personnel investigated four fish kills in 2010. One in Fairhaven required several days of follow up work.

Outreach

Staff communicated on recreational fisheries topics with the general public and recreational fishing community, including organized groups such as local schools, the Osterville Anglers Club, the Barnstable County League of Sportsmen, and the Cape Cod Salties. Informational materials were distributed at the Standish Sportsmen's Club, Eastern Fishing and Outdoors Exposition, Massachusetts Striped Bass Association Expo, the Rhode Island Saltwater Anglers Association Fishing Expo, the New England Boat Show, Needham Sports Club, and the Topsfield Fair.

The annual Anglers Guide and Regulatory Abstract were printed and distributed to over 140 bait and tackle shops and 30 other venues. Public presentations on fisheries management and program research were delivered to several clubs and school groups.

Large Pelagics Research Project

Massachusetts Sportfishing Tournament Monitoring Program

Extensive recreational fisheries for sharks, tunas, and marlins off the coast of Massachusetts warrant monitoring. In an effort to characterize the relative abundance of these species, the Massachusetts Sportfishing Tournament Monitoring Program has been collecting catch and effort data at fishing tournaments since 1987. These data allow analysis of annual trends in relative abundance based on angling success. The program has made efforts to rectify biases in the calculation of catch-per-unit effort indices from tournament data by surveying tournament participants and working with tournament organizers to collect complete catch information comprising all fish landed, tagged, released, and lost. Data collected include: fishing date, number of boats/fishermen, fishing time, species caught, time of catch, weight, length, sex, bait used, water temperature, disposition of catch (boated, released, tagged, lost), and weather conditions.

In 2010, data were collected at all major big game fishing tournaments held in Massachusetts. Although some tournaments were cancelled due to weather, catch and effort data were obtained from three multi-species tournaments, three shark tournaments, and two bluefin tuna tournaments (Table 6).

Table 6. 2010 Massachusetts offshore fishing tournaments

Tournament	Species	Dates
Oak Bluffs Monster Shark, 24th Annual	Shark	7/23-24
Nantucket Billfish	Billfish/tuna/shark	7/30-31
Falmouth Grand Prix, 21st Annual	Billfish/tuna/shark	8/13-14
Hyannis Shark, 2nd Annual	Shark	8/14
South Shore Tuna, 2nd Annual (Scituate)	Bluefin tuna	8/21-22
Nantucket Shark, 6th Annual	Shark	8/28-29
Hyannis Anglers Club Bluewater Billfish, 6th Annual	Billfish/tuna/shark	8/28-29
Nantucket Bluefin Blast	Bluefin tuna	9/11-12

Massachusetts Shark Research Program

MarineFisheries established the Massachusetts Shark Research Program in 1989 to more fully elucidate the ecology, distribution, and relative abundance of sharks subjected to fisheries off the coast of Massachusetts. The program conducts angler and longline surveys and opportunistically collects information and samples from recreational and commercial fishermen. Biological parameters including age determination, feeding ecology, movements, and reproductive status are examined through dissection and tagging of shark specimens. The goals of the research program are to foster cooperative shark research, to participate in the state, regional, and federal management process, and to provide public education and technical information on the biology, management, and utilization of sharks.

With the exception of trawl, longline, and gillnet fisheries that target spiny dogfish (*Squalus acanthias*), there are no directed commercial fisheries for sharks in Massachusetts. Of the 6.5 million pounds of sharks landed in the Commonwealth in 2010, over 99% were spiny dogfish with a commercial value of $1.36 million (Table 7). The balance consisted of shortfin mako (*Isurus oxyrinchus*, 0.6%) and porbeagle (*Lamna nasus*, <0.05%) taken incidental to trawl, longline, and gillnet fisheries.

Table 7. Estimates of 2010 commercial shark landings in Massachusetts

Species	Landings (lbs)	% of Catch	Value	Price/lb.
Spiny Dogfish	6,439,983	99.34%	$1,356,549	$0.21
Shortfin Mako	39,906	0.61%	$47,929	$1.20
Porbeagle	2,935	0.05%	$1,537	$0.52
Total	6,482,824		$1,406,015	$0.22

Source: SAFIS

A substantial recreational fishery for sharks occurs in Massachusetts from June through October each year. Harvest estimates from NMFS' MRIP indicate that Massachusetts' recreational fishermen caught about 736,000 sharks in 2009, with spiny and smooth dogfish comprising 99% of the catch (Table 8). However, MRIP data do not adequately reflect species composition, relative abundance, and temporal and spatial distribution of sharks and shark nursery habitat in these waters.

The data from our program (Table 8) indicate that of the 968 sharks caught during Massachusetts big game fishing tournaments in 2009, 917 (90%) were blue sharks (*Prionace glauca*), 82 (8%) were shortfin makos, and 16 (1.5%) were common thresher sharks (*Alopias vulpinus*); the balance included a single tiger shark (*Galeocerdo cuvier*) and a single porbeagle (*Lamna nasus*). During these events, 98% of the sharks were released. Although Massachusetts Sportfishing Tournament Monitoring Program data represent only tournament-caught sharks taken in offshore waters (>3 miles), they do provide an indication of species composition, landings, and catch rates for important recreational shark species in Massachusetts.

Table 8. Estimates of 2009 recreational shark landings (numbers) in Massachusetts

Source	Species	Boated	Released	Tagged	Total	Percent Released
MSTMP*	Blue		889	28	917	100%
	Shortfin Mako	9	70	3	82	89%
	Common Thresher	8	8		16	50%
	Tiger		1		1	100%
	Porbeagle	1			1	0%
	Total	**18**	**968**	**31**	**1,017**	**98%**
MRIP**	Dogfish	4,968	623,998		628,966	99%
	Sandbar/ Unidentified		106,738		106,738	100%
	Total	**4,968**	**730,736**		**735,704**	**99%**

* Massachusetts Sportfishing Tournament Monitoring Program
** NMFS' Marine Recreational Information Program (Source: NMFS, Fisheries Statistics Division)

Movement and Habitat Studies: With external funding from private and federal grants, Shark Research Program personnel continued in 2010 to collaborate with federal and academic researchers on the study of broad and fine-scale movements of numerous shark species using pop-up satellite tags. These species include porbeagles, shortfin makos, blue sharks, basking sharks, and sand tigers.

The advent of new tagging technologies has allowed researchers to examine the movements, habitat use, and behavior of white sharks in the Pacific and Indian Oceans, but, until recently, the elusive nature of this species in the Atlantic has been a roadblock to such studies in this region. Originally thought to feed primarily in offshore Atlantic waters, white sharks are exhibiting a dietary shift in response to changes in seal abundance. With Monomoy Island hosting a sizeable and growing population of gray seals, the numbers of shark sightings and white shark attacks on seals have been rising in recent years off the southeastern Massachusetts coast (Figure 17).

The relative increase in white sharks off the coast of Cape Cod allowed us to tag 13 individuals during the summers of 2009 and 2010 with satellite-based tracking tags or acoustic transmitters. This was the first successful effort to apply these tags to white sharks in the North Atlantic Ocean. Given the high profile nature of the white shark, these tagging efforts garnered considerable media attention.

Shark Nursery Habitat: With additional funding from the NMFS Proactive Species Conservation Grant Program and the Massachusetts Marine Fisheries Institute, a study was initiated to examine habitat use by the sand tiger in Plymouth-Kingston-Duxbury Bay, the largest nursery for this species north of Delaware Bay. Specifically, the project is designed to obtain detailed information on small scale movement and habitat use within the nursery and surrounding regions using acoustic telemetry. The study is being conducted by an SMAST graduate student working with Program personnel. In 2009 and 2010, more than 60 sand tigers were tagged in this embayment and tracked as far south as Florida.

Figure 17. A white shark (upper right corner) lurks near a group of grey seals

Post-release Survivorship Studies: The Program continued research on stress physiology in sharks in 2010. In cooperation with the New England Aquarium, a manuscript was published on the physiological effects of longline capture on sharks of the *Carcharhinidae* family. Working with a University of Massachusetts researcher, a study was initiated to study the physiological effects of longline capture in sandbar and dusky sharks. In 2010, a book chapter was published on the physiological stress responses in sharks. In conjunction with the aforementioned study on sand tiger movements, the physiological effects of capture stress are being investigated in this species. In 2009 and 2010, sand tigers were held captive to quantify the physiological effects of the capture stress and recovery. Post-release survival of sand tigers was monitored with passive acoustic telemetry and linked to blood chemistry data collected during the tagging process.

Feeding Ecology: With *MarineFisheries'* support, an SMAST student is conducting a study on the feeding ecology of smooth dogfish. Over the three years of the study, 370 smooth dogfish have been collected for stomach contents analysis. Major prey items included American lobster, rock crab, spider crab, and mantis shrimp.

On several occasions in 2010, technical evaluations were provided to marine mammal researchers, local officials, and the general public regarding the interaction of marine mammals with white sharks. In several cases, bite marks on the carcasses of gray seals, harbor seals, and right whales were analyzed for evidence of shark predation.

Shark Management: Program personnel participated in the development and/or amendment of state (*MarineFisheries*), interstate (ASFMC), federal (NMFS), and international (ICCAT) shark management plans. Greg Skomal is a member of the ASMFC Coastal Sharks Plan Development Team and chair of the ASMFC Coastal Sharks Technical Committee.

Outreach and Media: To meet the public's demand for information on sharks, especially white sharks, over 20 presentations pertaining to sharks were delivered by Program personnel in 2010 to the public. Technical information on sharks was also provided to several media outlets.

Diadromous Fish Passage and Restoration Project

Completed Projects (*MarineFisheries* lead)

Mystic Lake Dam Fish Ladder: The Massachusetts Department of Conservation and Recreation (*Mass*DCR) reconstructed the Mystic Lake Dam in 2010 and included a fish ladder and eel ramp (Figure 18). This project represents one of the highest priority projects in this region for *MarineFisheries* in the last two decades. *MarineFisheries* and the Medford Boat Club organized a herring bucket brigade from 2005-2009, which helped garner local and state support for the dam project. *MarineFisheries* funded USFWS to prepare a scoping design for the fish ladder and assisted with the design of an independent eel ramp. The fish ladder was completed in 2010 and additional work on the eel ramp and juvenile downstream passage facility are slated for completion during Phase II of the dam reconstruction in the winter of 2010/2011.

Figure 18. Reconstruction of the Mystic Lake dam, including the fish pass on the right

Pilgrim Lake, Orleans, Fishway Outlet: The fishway outlet was reconstructed at the Pilgrim Lake herring run during late winter 2010. *MarineFisheries* provided a USFWS contracted scoping design for the structure and paid for engineering plans when a shortfall with the U.S. Natural Resources Conservation Service's (NRCS) Wildlife Habitat Incentive Program threatened to scuttle the project. The job was completed in March just before the onset of the spring river herring run.

Cockeast Pond, Westport, Fishway Improvement: Working with the Town of Westport, an in-stream weir was installed below the fishway culvert into Cockeast Pond in March. The project was conducted with donated materials, labor, and a crane to lower granite blocks into the stream to correct an elevation error that occurred when the culvert was replaced two years before.

Pilgrim Lake, Orleans, Eel Pass: An eel pass was designed and installed by our fishway crew at the outlet to Pilgrim Lake in Orleans (Figure 19). Locals contacted *MarineFisheries* seeking improved eel passage at this location. After consultations and site visits, the crew installed a unique gravity-fed, sub-surface piped eel pass that moved about two thousand glass eels during a brief deployment in 2010; this technology has promise to assist eel passage in the future.

Figure 19. Installation of an innovative eel pass at Pilgrim Lake

New/Ongoing Projects (*MarineFisheries* partnership)

In addition to the projects outlined above, the following projects are divided by their status as either a project for which *MarineFisheries* is the proponent or projects that other entities lead and *MarineFisheries* offers technical assistance. Numerous other potential projects and information requests received some attention in 2010.

Leonard's Pond, Rochester: A contract was issued through the Town of Rochester to install an Alaskan Steeppass fish ladder at the Leonard's Pond Dam in December 2010. *MarineFisheries* paid for the scoping design from USFWS and two sections of steeppass for the project. The Coalition for Buzzards Bay funded the final design, engineering, and construction for the ladder.

Draka Dam, Dighton/Taunton: An engineering and permitting contract was awarded to install an Alaskan steeppass ladder at the Draka Dam on the Three Mile River in the summer of 2011. This long-dormant project was revisited in 2010 through contact with the dam owner and staging property owner. Once verbal approvals were received for the fish ladder construction, Save the Bay initiated a contract to re-start this project, which was first funded in 1999.

Town Brook, Quincy: An ISA contract was issued to seek options for restoring the longstanding degradation of smelt spawning habitat in Town Brook, Quincy. An ISA was drafted and submitted to utilize mitigation funds from court settlement of the 1997 smelt egg kill during the flood control project construction. The study report was expected in 2010, but will be delayed to early 2011.

Fore River Diadromous Fish Restoration: *MarineFisheries* contracted Dick Quinn of USFWS to design fish ladders for Hollingsworth Pond Dam and the dam at Great Pond Reservoir.

***Mass*DOT Diadromous Fish GIS Project:** Early in 2009, a project scope was drafted for hiring a contractor to assist with preparing a GIS data layer that includes diadromous fish habitat and *Mass*DOT transportation routes and structures. The project was approved by *Mass*DOT and *MarineFisheries* edited and submitted a final version of the project proposal in December.

Ongoing *MarineFisheries* Technical Assistance

Potential restoration projects are reviewed upon request from local, state, and federal agencies and other interested parties. The assistance ranges from brief technical advice to signing onto long-term projects as an active partner. In addition, routine assistance is provided upon request to potential projects in the form of site visits, proposal reviews, support letters, and information on existing resources.

Wapping Road Dam Removal, Kingston: *MarineFisheries* reviewed and commented on the second draft of a feasibility study on the Wapping Road dam removal project in Kingston. A support letter was drafted for the project's 2009 application to the Gulf of Maine Council and a site visit and conference call were attended to discuss the evolving design. Discussions were initiated with the City of Brockton's Water Department to plan fish passage improvements in Silver Lake in the Jones River Watershed following dam removal.

NRCS Cape Cod Plan: The NRCS Cape Cod regional restoration plan was approved by the U.S. Congress after nearly 10 years of planning. The restoration plan has the potential to address the most outstanding fish passage projects on Cape Cod over the next 10 years. This project required a large effort in 2010 with numerous meetings, conference calls, and site visits.

Mill River Dam Removal, Taunton: Communications were maintained on this project throughout the year and coordination began with *Mass*DCR, *Mass*DEP and *Mass*DER to plan a fish ladder at the Morey's Street Dam at the upstream headwaters. USFWS agreed to produce the scoping design for this ladder in FY10.

Martha's Vineyard Site Visit: Following local property owner requests, a site visit was made to investigate potential restoration projects at Trapps Pond, Edgartown and Mill Pond, West Tisbury. A restoration proposal memo was drafted and distributed on the Trapps Pond site.

River Herring Habitat Assessment

An effort was initiated in 2007 to develop standard operating procedures for assessing river herring spawning and nursery habitat. The procedures are part of a larger effort to finalize a *Mass*DEP-approved Quality Assurance and Program Plan for water chemistry and habitat measurements related to diadromous fish habitat. The intention is to develop protocols for

assessing habitats that can interact with *Mass*DEP's Surface Water Quality Criteria and contribute to *Mass*DEP's Watershed Assessments. *Mass*DEP reviewed draft procedures for temperature loggers, water chemistry sondes, rainbow smelt spawning habitat assessment, and river herring spawning and nursery habitat assessment from 2007-2009. In November 2009, *Mass*DEP approved the Quality Assurance and Program Plan and the document was submitted to the *MarineFisheries* Technical Report Series (TR-42). With this approval, water quality data collected by *MarineFisheries* while conducting diadromous fish habitat assessment can be applied to *Mass*DEP watershed assessment processes mandated by the Clean Water Act.

A report on the completed assessment at Upper Mystic Lake was completed in 2010, and entered into the *MarineFisheries* Technical Report Series (TR-44). This was the first such report completed under the Quality Assurance and Program Plan. Data analysis was underway for Silver Lake in the Jones River watershed for the next habitat assessment report. Monthly assessment trips were made from May through September at Hathaway Pond (Barnstable) and Leonard's Pond (Rochester) in the Sippican River watershed; Great Pond and Sunset Lake (Braintree) in the Fore River system; and Bourne Pond and Red Brook Pond (Bourne).

Rainbow Smelt Population Monitoring

Rainbow smelt are a popular sportfish in Massachusetts and important forage for many species of fish and wildlife. Smelt population declines since the 1980s prompted *MarineFisheries* to initiate spawning run monitoring using in-stream fyke nets in 2004. The fyke net catches of smelt provide a relative index of population abundance and age-structure data. The project has received funding support from the NOAA Office of Protected Species under two grants.

The project targeted 33 fyke net hauls over an 11 week season in eight coastal rivers in 2010. The project also conducted Passive Integrated Transponder (PIT) tagging of smelt in the Fore River, Braintree, to track spawning run movements and to obtain smelt gametes used for restoration stocking and genetic samples for a study under the NOAA grant collaboration. Smelt catches in 2009 were the lowest of the 2004-2010 time series. At 888 fish, the Fore River had the largest smelt run among sampling stations; however, this was still well below the 2005-2008 average of 2,263 smelt. Fore River smelt catch improved to 1,441 smelt in 2010, although the catch was dominated by age-1 smelt. The low catches of 2009 appear to be related to poor recruitment from the 2007 cohort. Further evidence to support this came in 2010 with the low representation of age-3 smelt (only 2.5% of total). Smelt catches did improve in the North and Crane rivers in 2010 where the project is stocking smelt larvae with oxytetracycline markers. Laboratory investigations will continue in 2011 to verify the proportion of North and Crane River smelt that possess the marker.

Another large effort was made in 2010 to begin preparations of a Gulf of Maine Rainbow Smelt Conservation Plan. The plan is the primary product of the NOAA Species of Concern grant received with New Hampshire and Maine. In addition, planning was underway for the 4th North American Rainbow Smelt Workshop to be held in January 2011 in Portland, Maine. The Species of Concern grant is funding the workshop and *MarineFisheries* is a co-sponsor.

American Eel Young-of-the-Year Monitoring

All east coast states conduct standardized monitoring of YOY American eel under mandatory ASMFC protocols. *MarineFisheries* has monitored the spring migration of YOY eels in the Jones River since 2001 to contribute to a coastwide index of eel population relative abundance. YOY monitoring stations are also maintained in the Acushnet, Saugus, and Parker Rivers. The project targeted 40 Sheldon trap hauls over a 10-week season at the four stations in 2010. The Jones River trap catch of 1,489 eels was the lowest in the 10-year time series. This catch represents a sharp reduction from the 8,146 eels caught in 2009, and even more so from the high catches of 18 to 20 thousand eels annually for 2005 – 2008.

The project also works with volunteer organizations to monitor juvenile eels using eel passage ramps in the Saugus River, Wankinco River, and Cold Brook. The eel ramps were designed by *Marine Fisheries* starting in 2007 to allow eels to pass over dams. Eel ramp catches represent a census of eels able to move upstream of the dams. The seasonal catches at the ramps has been 5 to 10 thousand eels from 2007-2010, with the exception of over 25,000 eels passed at Cold Brook in 2009. A new eel pass was installed by DMF at Pilgrim Lake in Orleans in 2010. The Pilgrim Lake eel pass is an innovative design that uses gravity flow to transport eels through an attraction pipe below the dam to a holding tank above the dam. With only about five weeks of operation, over 2,000 eels were collected by the gravity-flow eel pass in 2010.

A large effort was made in 2010 to contribute to ASMFC American Eel TC proceedings. Brad Chase was nominated to serve as the committee's next chairman and was asked to serve on the stock assessment subcommittee.

HubLine Restoration

Anadromous fish restoration is a component of HubLine mitigation and resource restoration efforts. In 2007 and 2008, scopes of work were drafted for the following five HubLine restoration projects: Herring River (Pembroke), Bound Brook (Scituate), Weir River (Hingham), Back River (Weymouth), and the Fore River (Braintree). All but the Bound Brook projects were active in 2010.

Weir River (Hingham) Smelt Habitat Restoration: The feasibility study for restoring smelt habitat in the Weir River at Foundry Pond Dam was ongoing throughout 2010. The contractor, Gomez and Sullivan Engineers, had delays that required a contract extension. A draft final report was received in December 2010 and sent to *Mass*DEP to initiate the permitting process.

Back River (Weymouth) Anadromous Fish Habitat Improvement: Assistance continued to the Town of Weymouth to process a contract for removing sediment from the channels of the Back River river herring and smelt runs. Staff investigated sediment removal technologies and reviewed the request for proposals for contracting the work. Channel improvement work was conducted in February 2010 to remove an in-stream rock weir that degraded smelt habitat.

Herring Brook (Pembroke) Fish Ladder Replacement: A project to replace the fish ladder began in 2009 with an agreement to have the Massachusetts Public Access Board lead the

development of engineering plans. The engineering plans for this ladder were completed in 2010 and the project will be bid for construction in 2011.

Fore River (Braintree) River Herring Restoration Project: Fish ladder scoping designs for two locations were assigned to the USFWS fishway engineer as part of our annual contract. These designs were not complete at of the end of 2010.

Anadromous Fish Restoration Priority List

A major effort was made to update the anadromous fish restoration priority list and to develop a GIS data layer linking anadromous fish habitat to *Mass*DOT infrastructure. *Mass*DOT contracted AECOM to develop the *Mass*GIS data layer. Second drafts of the four coastal drainage areas were sent to AECOM in 2010 after extensive updates and revisions. Work will continue in 2011 to QA/QC the data for the four regions and to consolidate the files into a single data layer with metadata on species life history, time-of-year restrictions, and *MarineFisheries* sampling stations.

Anadromous Fish Biology and Management Project

Propagation

Efforts to reestablish, augment, and enhance natal anadromous runs in conjunction with ongoing fishway improvement projects included a total of 17,100 pre-spawning adult river herring trapped and transported via stocking truck or lifted above a barrier into seven coastal systems throughout the Commonwealth. The seven systems that received gravid fish in 2010 were: Sippican River, Rochester; Herring Brook, Pembroke/Hanson; Town Brook, Plymouth; Island Creek, Duxbury; Monument River, Bourne/Plymouth; Three Mile River, Dighton; and Eel River, Plymouth. An additional 1,100 alewife were trapped from a Massachusetts donor system in a cooperative effort with the state of Rhode Island and released into two of their coastal systems (Ten Mile River, East Providence) in an effort to sustain their small populations.

Restoration efforts of American shad to the Charles River system also continued with the introduction of 3.8 million shad fry into the waters around the Woerd Avenue Boat Launch in Waltham; assessment of these efforts is ongoing.

Construction and Improvements to Passage Facilities

A total of 23 different fishways in 17 different river systems were attended to prior to the commencement of the 2010 spring spawning migrations (Table 9).

A cooperative effort between *MarineFisheries*, *Mass*DCR, and EOEEA resulted in reconstruction of the deteriorating Mystic Lake dam and fishway. Prior to this construction, river herring were unable to access spawning habitat in the Upper Mystic Lake (165 acres), and joint efforts between state agencies, watershed associations, and citizen's groups to trap and transport spawning adults into the upper spawning habitat were conducted in previous years. The $5 million re-construction project is scheduled to be completed in 2011.

Table 9. MA fishway and town where work was performed

Fishway	Location
Elks Ladder	Wareham
Harodite Dam	Dighton
Hunters Pond Dam	Cohasset
Shad Factory Pond	Rehoboth
Veterans Memorial Park Dam	Marshfield
Second Mill Pond Dam	Pembroke
Mill Pond Dam	Wareham
Dick's Pond Dam	Wareham
Northbound Route 25 Red Brook	Wareham
Route 130 Crossing	Mashpee
Mashpee Pond Control Structure	Mashpee
Santuit Pond Dam	Mashpee
Mill Pond Dam	Barnstable
Iron Hill	Weymouth
Jackson Square	Weymouth
Broad Street Dam	Weymouth
Elm Street Dam	Kingston
Jenny Grist Mill	Plymouth
Newfield Street Dam	Plymouth
Watertown Dam	Watertown
Moody Street Dam	Waltham
Upper Shawme Pond	Sandwich
Lower Shawme Pond	Sandwich

MarineFisheries continued to work closely with the town of Sandwich to evaluate the new Alaskan Steeppass fishway installed within the rebuilt Upper Shawme Pond dam; the fishway reestablishes fish passage into the uppermost spawning area of the system (Figure 20).

Figure 20. Alaskan Steeppass installation at Upper Shawme Pond

In addition, the crew worked on at least one site project each month throughout the year, clearing river debris, constructing fish diverters, trash racks, construction forms, fishway baffles, coffer dams, and eel ramps as required for the Anadromous Fish Biology and Management project, local partners, and constituent groups.

Biological Assessments for River Herring

The alewife (*Alosa pseudoharengus*) is the most abundant anadromous fish in Massachusetts. A close "cousin" is the blueback herring (*Alosa aestivalis)* which, although a separate species, is often confused with the alewife. The species are usually lumped together under the heading of river herring.

Biological studies continued with adult river herring counts and sample collections from the Monument River, Bournedale; Town Brook, Plymouth; Mystic River, Medford; Agawam River, Wareham; Wankinco River, Wareham; Mattapoisett River, Mattapoisett; Nemasket River, Middleboro; Merrimack River, Lawrence; and the Acushnet River, Acushnet. A total of 2,084 river herring (plus 181 American shad) were sampled and assessed from six of these nine coastal systems. Data indicates that river herring populations are truncated in age structure, with fewer older fish being collected and fish apparently smaller at age than in past years. Counts varied from approximately 12,319 fish in the Mattapoisett River to 763,884 in the Nemasket River. Electronic monitoring of several coastal systems indicated that there was an increase in the number of fish returning to their natal spawning grounds in some systems in 2010. Counts in the Mattapoisett River increased modestly (12,319 in 2010 vs. 10,356 in 2009) while counts in the Acushnet River almost doubled (2,658 in 2010 vs. 1,799 in 2009). However, adult returns declined substantially in the Monument River (106,210 in 2010 vs. 185,862 in 2009).

Passage of diadromous species is monitored during the spring/summer each year at the first obstruction on the Merrimack River in Lawrence, Massachusetts. Counts of American shad on the Merrimack River for 2010 (10,343 fish) declined significantly compared to 2009 (23,199 fish) and 2008 (25,116 fish). This remained an improvement over the 1,205 fish lifted in 2006. In addition, 48 striped bass, 3,433 sea lamprey, and 517 river herring (a decrease from 1,456 river herring in 2009) were also lifted above the dam in 2010.

Outreach

During the past year, information on the status of 26 coastal river systems for fish passages and fish stock status was collected, evaluated, and/or distributed. Water quality and environmental parameters were recorded for many of the anadromous runs investigated. Project personnel responded to numerous requests for information from private, local, municipal, state, and federal agencies as well as citizens of the Commonwealth throughout the year.

ADMINISTRATION

Personnel

Kevin Creighton, Chief Fiscal Officer

Finance
Darlene Pari, Accounts Payable Coordinator
Eva Morales, Accountant III
Jeanne Hayes, Accounts Receivable Coordinator
Shannon Davis, Program Coordinator - Revenue

Boston Permit Office
Kerry Allard, Head of Permitting
Cecil French, Permitting Supervisor
Kerry Faugno, Permitting Receiving Teller
Sandra Downing, Permitting Receiving Teller

New Bedford Permit Office
Marie Callahan, Permitting Office Manager
Kim Trotto, Permitting and Administrative Support

Gloucester Permit Office
Rosemary Mitchell, Permitting and Administrative Support

Grant Programs
Stephanie Cunningham, Federal Aid and Grants Coordinator
Tom Beaulieu, Project Leader, Clean Vessel Act
Eileen Feeney, Program Coordinator, Clean Vessel Act

Capital Assets and Facilities Management
Bruce Estrella, New Bedford Office Facility Chief
Brian Castonguay, Gloucester Office, Head of Facilities and Capital Assets
Ralph Stevens, Shellfish Purification Plant, Facilities

Overview

MarineFisheries Administrative Bureau is responsible for the Division's fiscal functions, permitting, grants management, and capital assets. The Bureau develops, analyzes, and manages the Division's financial planning and resource allocation activities including budget submissions to the Legislature. Analysts provide financial and performance analysis of Division programs, operations, and policies. Their responsibilities include: monitoring and forecasting revenue and expenditures; preparing the Division's annual budget recommendation and spending plans; working with Department, Legislative and Executive Branch budget staff; identifying and monitoring key budget and policy issues; and analyzing and proposing policy and savings initiatives. The Bureau is responsible for permit issuance, collecting fees, and reconciling revenue. The Bureau also provides all fiscal oversight and reporting on grants, contracts, and mitigation projects. In addition, all capital assets are procured, inventoried, managed, and maintained through the Bureau. Facilities

Management is conducted with the intent to provide a healthy and productive working environment. This is accomplished by supplying staff with the tools needed to meet their project's goals and objectives. This includes a safe working environment and equipment, vehicles, and vessels maintained and repaired on a timely basis as necessary.

Budget

State-Appropriated Funds

The economic downturn that required the Commonwealth to reduce spending in fiscal year 2009 continued into fiscal year 2010. The impact on the *MarineFisheries* FY2010 operating budget reflected a reduction of almost 10%. However, 1% of the reduction can be attributed to Executive Order 510 (E.O. 510), and does not reflect an actual loss to the overall budget. The fiscal year 2009 and 2010 state appropriations are shown in Table 10.

Table 10. Fiscal Year 2009 and Initial 2010 Appropriations

Title	Acct. Number	FY2009	FY2010	Change
General Operating	2330-0100	$5,062,311	$4,522,821	-10.7%
Sport Fish Program	2330-0120	$571,063	$544,860	-4.6%
Sport Fish Retained Revenue	2330-0121	$217,989	$217,989	0
Total		$5,851,363	$5,285,670	-9.7%

In February of 2009, Governor Deval Patrick enacted E.O. 510 to streamline and consolidate the information technology (IT) infrastructure of the Commonwealth. E.O. 510 included the transfer of IT funds from agencies to the secretariat level, resulting in an overall reduction of approximately 1% to the *MarineFisheries* approved budget for fiscal year 2010. As the IT expenses were moved to the Executive Office along with the funds, this 1% reduction does not reflect an actual loss to the overall *MarineFisheries* operating budget.

To meet the requirements of the remaining 9% reduction to the operating budget, the Division aggressively sought out "soft money" via grant opportunities and shifted costs where appropriate. In addition, all state-funded travel was suspended, spending in the lower subsidiaries was drastically reduced, five full-time employee positions were eliminated, and most full-time employees were required to take a one week unpaid furlough.

The breakdown of overall costs by primary spending category for the *MarineFisheries* operating accounts can be seen in Table 11 and Figure 21.

Table 11. Fiscal Year 2010 Costs, State Appropriations

Account Number	2330-0100	2330-0120	2330-0121	Line Total
Salaries	$3,825,025.66	$536,416.95	$12,513.34	$4,373,955.95
Employee Expenses	$4,646.69	$38.00	$8,505.51	$13,190.20
Contracts	$9,200.00		$87,996.30	$97,196.30
Facility Maintenance	$36,888.08		$4,190.00	$41,078.08
Field & Lab Supplies	$43,199.19		$7,643.81	$50,843.00
Fringe Costs	$53,167.55	$7,402.57	$172.68	$60,742.80
Fuel	$46,642.10		$6,362.54	$53,004.64
Utilities	$114,100.53		$77.16	$114,177.69
Lease/Rent	$80,111.58			$80,111.58
Maintenance/Repair	$46,139.19			$46,139.19
Office & Administrative	$87,220.04	$0.00	$53,333.62	$140,553.66
Services/Equipment Lease	$12,680.45		$18,626.00	$31,306.45
Information/Technology			$900.86	$900.86
Government Contracts			$10,441.44	$10,441.44
Outside Agencies	$131,072.42		$1,099.95	$132,172.37

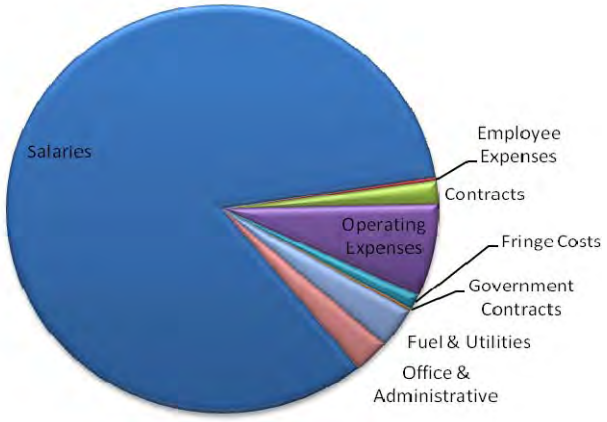

Figure 21. FY2010 Spending Category Summary

Staffing

Authorized personnel levels for calendar year 2010 are shown in Table 12.

Table 12. Fiscal Year 2009 and 2010 Authorized Personnel Levels

Title	Acct. Number	FY2009	FY2010
MarineFisheries General Operating	2330-0100	75	70
Sport Fish Program	2330-0120	10	10
Federal Grants and Trust Account	2330-xxxx*	14	22
Total Employees in All Appropriations		**99**	**102**

*Multiple account numbers.

Although a total of five full-time positions were eliminated over the course of fiscal year 2010, *MarineFisheries* increased its total full-time employee count by three positions in comparison to fiscal year 2009. The positions that were eliminated include one receiving

teller from the permitting program, one biologist from the horseshoe crab program, one laborer from the shellfish purification plant, one bacteriologist from the South Coast shellfish program, and one senior biologist from the shellfish program.

Reductions to the overall operating budget did not allow for any of these positions to be backfilled. However, as noted above, *MarineFisheries* was very successful in the submittal and receipt of several grant awards over the previous year that has resulted in growth of several programs. Specifically, the Fish Age & Growth lab was built out in the *MarineFisheries* Gloucester facility and included three new positions; the red tide grant allowed for renovations of the red tide lab and included two new positions; the eel-grass mitigation project included two new positions; and one new position was added to the sportfish program by utilizing sportfish restoration funds.

Revenue

MarineFisheries collects fees primarily from permit issuance and from processing racks of soft-shelled clams at the Shellfish Purification plant. A total of 34,743 permits and endorsements were issued by the Licensing Program producing revenue of $2,106,340 in 2010. This represents a slight decrease in revenue (~1.15%) from permit issuance in 2009. The Shellfish Purification Plant in Newburyport processed 13,864 racks of soft-shelled clams in 2010. This resulted in revenues of $83,184, which is a 7% decrease over the 2009 value of $89,394.

Commercial Fisherman Permits

Anyone who lands and sells finfish, shellfish, lobsters, edible crabs, or other living marine resources in Massachusetts must have a *MarineFisheries* commercial fishing permit and must sell only to licensed Massachusetts dealers. All commercial permits, except Rod & Reel and Seasonal Lobster, may be endorsed for shellfish at no additional cost. See Table 13 for the number of commercial fishing permits issued, by type, in 2010 and resulting revenue.

Table 13. 2010 Commercial Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Coastal Lobster ($260/NA)	1,271	7	$334,100
Offshore Lobster ($260/$520)	346	106	$145,080
Seasonal Lobster ($65/$130)	120	3	$8,190
Boat 99'+ ($260/$520)	14	19	$13,520
Boat 60-99' ($195/$390)	69	135	$66,105
Boat 0-59' ($130/$260)	2,810	291	$440,960
Individual ($65/$130)	339	20	$24,635
Shellfish ($40/$80)	963	27	$40,680
Shellfish & Rod & Reel ($55/$130)	491	1	$27,135
Rod & Reel ($35/$100)	783	87	$36,105

Coastal Lobster Permit allows the taking, landing, and sale of lobsters and edible crabs (to a licensed dealer) harvested from within the coastal waters of the Commonwealth. There is a maximum pot limit per vessel that is based on Lobster Management Areas and individual

allocations. The permit may be endorsed to take and sell shellfish and finfish at no additional cost. In the case of skin or scuba divers, only the licensee is covered.

Offshore Lobster Permit allows the landing and sale of lobsters and edible crabs (to a licensed dealer) taken outside of the coastal waters of the Commonwealth only; pursuant to appropriate federal permit(s). If the permit is endorsed for the use of pots to harvest lobster, there is a maximum pot limit per vessel that is based on Lobster Management Areas and individual allocations. The permit may be endorsed to take and sell shellfish and finfish at no additional cost.

Seasonal Lobster Permit is issued to full-time students only (verification required), and allows the licensee only to take and sell lobsters and edible crabs (to a licensed dealer) from June 15 - September 15. A maximum of 25 pots may be used. Diving is not permitted; sale of fish and/or shellfish in not permitted.

Boat Permit allows the taking, landing, and sale of fish (to a licensed dealer) and may be endorsed for shellfish. The permit covers everyone aboard the vessel. Price varies with vessel size. No lobsters or edible crabs may be taken.

Individual Permit allows the holder only to take, land, and sell fish (to a licensed dealer) and may be endorsed for shellfish. No lobster or edible crabs may be taken.

Shellfish Permit allows an individual to take, land, and sell (to a licensed dealer) shellfish and seaworms. A shellfish ID card from *MarineFisheries* and a town permit are also required.

Rod & Reel Permit allows the holder only, to catch and sell finfish (to a licensed dealer) caught by Rod & Reel only. No other gear types may be used.

Dealer Permits

Anyone engaged in the wholesale or retail trade of raw fish, shellfish, lobsters, or bait, whether frozen or unfrozen, must have a *MarineFisheries* dealer permit and may be subject to inspection from the Massachusetts Department of Public Health (*Mass*DPH). Shellfish dealers must check Food and Drug regulations for tagging and record keeping. Massachusetts seafood dealers who purchase seafood products, even if for bait purposes, directly from fishermen are considered primary buyers, and must be so endorsed on their dealer permits. See Table 14 for the number of dealer permits issued, by type, in 2010 and resulting revenue.

Table 14. 2010 Dealer Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Wholesale Dealer ($130/$260)	373	11	$51,350
Wholesale Truck ($130/$260)	98	105	$40,040
Wholesale Broker ($130/$260)	23	1	$3,250
Retail Dealer ($65/$130)	745	1	$48,555
Retail Truck($65/$130)	56	4	$4,160
Retail Boat ($65/$130)	88	1	$5,850
Bait Dealer ($65/$130)	155	13	$11,765

Wholesale Seafood Dealer Permit allows the holder to acquire, handle, store, distribute, process, fillet, ship or sell raw fish and/or shellfish, whether frozen or unfrozen, in bulk or for resale. It also allows retail sales from the same single, fixed location. An approved inspection from the Division of Food and Drugs is required. A copy of the inspection report must be submitted with the application to *MarineFisheries*. The name and address must be the same on the inspection report and permit. This permit may be endorsed for bait (excluding shellfish), with an inspection specifically stating, "Approved for Retail and Bait License". A Hazard Analysis and Critical Control Points (HACCP) plan is required.

Wholesale Seafood Truck Dealer Permit allows the holder to acquire, handle, distribute, ship or sell raw fish, whether frozen or unfrozen, in bulk or for resale from a truck only. It does not allow the holder to process raw fish, whether frozen or unfrozen, lobster or shellfish. Nor does it allow the holder to purchase shellfish or shuck, relabel or repack shellfish. An approved inspection from the Division of Food and Drugs is required. A copy of the inspection report must be submitted with the application to *MarineFisheries*.

Wholesale Seafood Broker Permit allows the holder to act as an agent who negotiates contracts of purchase and sale of seafood. The brokerage activities will not involve the actual handling, processing or reshipping of finfish, shellfish or other marine resources. A "broker only" waiver must be filed in lieu of a health inspection.

Retail Seafood Dealer Permit allows the holder to sell raw fish, whether frozen or unfrozen, shellfish and lobsters at one retail location. The holder must purchase shellfish only from a holder of a wholesale dealer or wholesale truck permit, or from a certified out-of state wholesale dealer. Shellfish CANNOT be purchased directly from a harvester. It does not allow the holder to shuck, relabel or repack shellfish. An approved inspection from the Division of Food and Drugs must be submitted to *MarineFisheries*. The name and address must be the same on the inspection report and permit. This permit may be endorsed for bait (excluding shellfish). The inspection must specifically state "Approved for retail and bait license".

Retail Seafood Truck Dealer Permit allows the holder to sell fish or lobsters at retail from a mobile unit (does not include shellfish). It does not allow the holder to process, fillet, shuck, cook, etc. An inspection is required from a town or county Board of Health. A copy of the inspection must be submitted with the application. The name and address must be the same on the inspection report and permit. A Hawkers and Peddlers permit may also be required.

Retail Boat Seafood Dealer Permit allows the holder to sell "whole" fish and lobsters from his/her boat only (does not include shellfish). A commercial fisherman's permit is required in addition to this permit. A boat waiver must be filed in lieu of a health inspection.

Bait Dealer Permit allows the holder to take and sell marine bait. No inspection is required. Local regulations (i.e., on worms, eels, etc.) may apply.

Special Permits

Special permits are required for scientific collection, shellfish aquaculture, shellfish propagation, contaminated shellfish harvest, and for the non-commercial harvest of lobster. Regulated fisheries are issued as endorsements on commercial permits. See Table 15 for the number of special permits issued, by type, in 2010 and resulting revenue.

Table 15. 2010 Special Licensing and Revenue Statistics

Permit Type (and resident/non-resident fee)	Permits Issued (#)		Revenue
	Resident	Non-Resident	
Non-Commercial Lobster ($40/$60)	9,142	195	$377,380
Regulated Fishery Endorsements ($30/$60)	13,608	820	$402,780
Master Digger ($250/$500)	7		$1,750
Subordinate Digger ($100/$200)	89		$8,900
Scientific Collection ($10/$20)	72	19	$1,100
"Other" Special Permits ($10/$20)	298		$2,980
For-Hire Endorsement ($10/$20)	837	80	$9,970

Non-Commercial Lobster Permit is required to fish for or take lobsters and edible crabs for personal use. This authorizes the holder and members of the holders' immediate family, residing in the same residence, to fish for and take lobsters using 10 pots only. The immediate family is defined as the spouse, parents, children, grandparents, brothers, and sisters of the holder. This permit may be endorsed for diving by the permit holder only. Other family members may purchase additional permits for diving only.

Regulated Fishery Endorsement is required for commercial fishing in certain areas under certain conditions. Regulated fishery endorsement are required for dragging, gillnetting, and netting in inshore net areas, and for setting fish pots in waters under the jurisdiction of the Commonwealth. Regulated fishery endorsements are also required for the commercial harvest of northern shrimp, surf clams, ocean quahogs, sea herring, sea urchins, fluke, black sea bass, scup, striped bass, dogfish, American eel, horseshoe crabs, and groundfish.

Master Digger Permit is required for an individual who wants to harvest contaminated clams from areas classified as “restricted”. Shellfish are depurated at the Shellfish Purification Plant in Newburyport in accordance with regulations and established procedures. In addition to this application form, applicants must also include a $1,000 surety bond, sign a master digger affidavit, have their vehicle inspected and approved by *Mass*DPH Division of Food and Drugs, and they must be at least 18 years of age, and may not possess an “open” area commercial shellfish license at the same time as a Master Digger Permit.

Subordinate Digger Permit is required for the harvest of contaminated clams from areas classified as “restricted”. Shellfish are depurated at the Shellfish Purification Plant in Newburyport in accordance with regulations and established procedures. Subordinate diggers must work for a Master Digger, they must be at least 18 years of age, and may not possess an “open” area commercial shellfish license at the same time as a Subordinate Digger Permit.

Other Special Permits are required for specific activities in the marine environment, including; aquaculture, scientific collection, shellfish propagation, and shellfish relay.

Recreational Fishing Permit

Governor Deval Patrick signed into law “*An Act Instituting Saltwater Fishing Licenses*” (Saltwater Act) on November 23, 2009. In January of 2010, the Department of Fish and Game entered into an agreement with Active Outdoors to build and host an electronic licensing system to accommodate the issuance of recreational permits issued by the Division

of Fisheries & Wildlife as well as recreational permits issued by the Division of Marine Fisheries. Over the course of the year, *MarineFisheries* permitting staff dedicated thousands of man hours to the development and testing of the electronic licensing system. The system went live in December of 2010 for the issuance of calendar year 2011 recreational permits; a total of 787 recreational saltwater fishing permits were issued by December 31, 2010.

A recreational saltwater fishing permit is required of all fishermen age 16 and over. Exceptions have been made for anglers fishing aboard legally permitted for-hire vessels, individuals that are disabled, and for those fishermen with a valid recreational saltwater fishing permit from another coastal state that has entered into a reciprocity agreement with Massachusetts. The fee for the permit has been set at $10 for fishermen between the ages of 16 and 59, inclusive. The permit is free for fishermen aged 60 and over. During 2010, the National Marine Fisheries Service instituted a one-year, free registry for saltwater fishermen, resulting in approximately 150,000 registrations being issued to Massachusetts residents.

Grants

Between FY2006 and FY2008, *MarineFisheries* had spent approximately $4 million annually on federal grants and mitigation projects operating out of the *MarineFisheries* Trust account. In fiscal year 2009, *MarineFisheries* received a grant providing economic relief to commercial groundfish fishermen as a result of the federal enactment of Framework 42. The Framework 42 Economic Assistance Grant was valued at over $13 million, resulting in a dramatic increase in overall federal grant spending for the fiscal year.

In fiscal year 2010, *MarineFisheries* spent approximately $5.8 million on grants and mitigation projects with new growth primarily attributed to the following:

- A $2 million economic assistance grant to enhance sampling and testing of shellfish for red tide, and to provide economic relief to shellfish fishermen impacted by the dramatic red tide event that occurred in 2008;
- A fully staffed and implemented Fish Age & Growth grant that had been awarded during the previous fiscal year;
- A $700,000 eel-grass mitigation project that was funded as a result of the Algonquin HubLine Project in Massachusetts; and
- Several new research grants awarded through entities such as the Northeast Consortium, Commercial Fisheries Research Foundation, Marine Fisheries Institute, Gulf of Maine Council, Sea Watch International, as well as multiple private donors for sponsored shark research.

The Federal Grant Awards and expenditures out of the *MarineFisheries'* Trust are provided in Table 16.

Table 16. Fiscal Year 2009 and 2010 Appropriations

Title of Federal Grant or Trust	Account Number	FY2009	FY2010
Clean Vessel Act	2330-9222	$850,000	$850,000
Fisheries Statistics	2330-9712	$135,000	$135,000
Right Whale Conservation	2330-9713	$340,000	$40,000
Anadromous Fisheries	2330-9721	$22,000	$22,000
Boating Infrastructure	2330-9725	$100,000	$100,000
Lobster Investigations	2330-9726	$60,000	$0
Interstate Fisheries	2330-9730	$233,000	$233,000
ACCSP	2330-9732	$30,000	$50,000
Economic Relief	2330-9738	$12,000,000	$2,000,000
Turtle Disentanglement	2330-9739	$40,000	$60,000
Fish Age & Growth	2330-9742	$5,000	$215,000
Marine Fisheries Research Trust	2330-0101	$1,960,000	$2,288,000

The Clean Vessel Act Program

MarineFisheries administers the Clean Vessel Act (CVA) Program in order to insure that adequate and reasonably available pumpout facilities are provided to meet the needs of recreational boaters using Massachusetts coastal waters. This includes the identification of appropriate sites for additional pumpout equipment, readily available technical assistance for both the boater and others in need of information regarding the MassCVA Program, and agency coordination with public and private parties.

In 2010, *MarineFisheries* enjoyed its 16th year of participation in the CVA Grant Program. Sixteen years ago, few boaters even considered using their holding tanks; now the demand for pumpouts along the fifteen hundred miles of Massachusetts coastline is greater than ever, representing an entirely new attitude regarding boaters' personal share of responsibility for clean water.

We continue to remain steadfast in supporting the backbone of our program-participant operation and maintenance funding, inspection protocols, and needs assessment initiatives. All activities are sustained by our strong program administration. With these tools, we continue to build on our program's strengths, tackle new challenges, and form a vision for many more years of clean boating in Massachusetts.

Innovative Ideas, Accomplishments, and Outreach: We work towards providing comprehensive availability of no-cost pumpout service through new infrastructure and funding sub-grantees for operation and maintenance costs. Also, we seek to educate and inform boat owners and operators; federal, state and local governmental authorities and organizations; the environmental community; and the general public, about CVA and the numerous benefits to participating in the Program.

The geography of the Massachusetts coastline, with its hundreds of bays, coves, and inlets, and our short, intense New England boating season, make it fiscally impossible to site enough fixed shore-side facilities to adequately service the total boating population in the coastal zone. Consequently, we have been a leader in the implementation of pumpout vessel use; our combination of pumpout vessels (Figure 22) and shore-side pumpouts and

dump stations has created much wider boater access along the coast than twice the number of conventional shore-side facilities could have provided, and has been instrumental in Massachusetts' efforts to establish a statewide No Discharge Area (NDA). Providing this type of operator support was one of the key recommendations in the Sport Fish and Boating Partnership Council's 2008 review of the National CVA Program. *Mass*CVA has been providing this innovative funding since the program's inception.

Figure 22. Pump out boat

We are also moving ahead with our preemptive compliance program, capital reinvestment program, and innovative embayments incentive program. In particular, our capital reinvestment program has enabled *Mass*CVA to expand with minimal costs to new sub-grantees that lack the capital for a full investment in new infrastructure. Through this program, when a sub-grantee replaces an existing *Mass*CVA pumpout boat or fixed-location station, the replaced equipment is placed with a new applicant who will pay to have it refurbished at a fraction of the cost of new equipment.

The *Mass*CVA Program has wide participation with public, private, and non-profit partners. In 2010, we entered into several new partnerships; our sub-grantees include 42 private marinas, three non-profit organizations, and 50 cities and towns. Also, we are currently partnering with two federal agencies, three state agencies, one local university, and more than a half dozen non-profit organizations as part of our information and education efforts.

In 2010, we revitalized our outreach program, allowing us to connect with new communities and embayments. We also completed our fourth consecutive year of exhibiting, in partnership with our state boating law enforcement agency, at the New England Boat Show. This has led to record increases in requests for new infrastructure from new operators allowing us to fill long standing gaps in pumpout coverage coastwide and increase awareness of the *Mass*CVA Program among boaters and the general public.

As a direct result of our successful outreach and needs assessment efforts to sub-grantees and the general public, program shortfalls are being more effectively identified and addressed. In addition, NDA designations have been approved in three new large embayments: Boston Harbor, Cape Cod Bay, and Salem Sound, and new applications have been filed for the remaining Massachusetts coastline. The *Mass*CVA Program was proactive in reaching out to communities and private marina operators early in the NDA application process. Consequently, this year's request for new infrastructure (Table 17) has again exceeded expectations and we are quickly approaching the removal of more than 4 million gallons of effluent from state coastal waters.

Table 17. New Infrastructure for 2010

Location	Infrastructure Type
Braintree Yacht Club	New Fixed Location Pumpout Station
Hatter's Point Marina	New Fixed Location Pumpout Station
Mariner's Port Marina	New Fixed Location Pumpout Station
The Town of Rockport	New Pumpout Boat

The total project costs for the aforementioned new equipment was $14,250. In addition, $822,400 was distributed to 83 sub-grantees to cover the operation and maintenance expenses of 65 pumpout boats and 52 fully functional "Fixed-Location" Pumpout Stations.

Boating Infrastructure Grant Program

The Massachusetts Boating Infrastructure Grant (BIG) Program, begun in 2001, is a two-tiered federal grant program, directed through the USFWS and administered by *MarineFisheries*. The BIG Program is paid for by money from the Sport Fish Restoration Fund which in turn is funded by a small percentage of the Federal Gasoline Tax – an amount which represents fuel purchased by boaters across the nation. BIG is designed to provide grants to upgrade or install facilities for transient recreational boats 26 feet or more in length at public or partnered private facilities.

Tier I grants are limited to about $100,000 per year per state with the advantage of using a more streamlined state approval process. The Massachusetts BIG Program has attempted to fund as many qualified projects as possible each year under Tier I. Since 2001, the BIG Program has granted awards for 12 projects in eight different communities totaling $649,566 (Table 18). Awards averaged $54,131 per project.

Proposed projects filed under Tier II can be much larger in scope than those in Tier I. Unlike Tier I, Tier II proposals are judged in a nationally competitive process based on a strict point system. Massachusetts has not yet won a successful Tier II project.

Both grant tiers are reimbursement grants, meaning that payments are made upon the submission of invoices for work accomplished. Selected applicants provide at least a 25% match for Federal funds received. All payments are based on 75% reimbursement of invoices from work completed. The federal regulation on BIG can be viewed in its entirety at the USFWS website.

Table 18. Massachusetts BIG Project Summary

Year	Project	Award	% Complete
2001	Nantucket Transient Boater Restrooms (Town Pier)	$90,413	100%
	Tisbury Transient Dockage & Dinghy Dock (Lake Tashmoo)	$52,000	100%
2002	Wellfleet Transient Dockage (Town Pier)	$62,625	100%
	Chatham Transient Moorings & Navigational Aids (Stage Harbor)	$15,000	100%
2003	Chatham Transient Boater Restrooms (Stage Harbor)	$69,000	100%
	Beverly Transient Moorings (Great Misery Island)	$17,394	100%
2004	Boston Harbor Islands Transient Moorings (Long Island)	$25,000	100%
	Boston Harbor Islands Transient Moorings (Peddocks Island)		
	Owen Park Transient Dockage (Vineyard Harbor)	$53,752	100%
2005	Provincetown Transient Courtesy Float (MacMillan Pier)	$60,000	100%
	Nantucket Transient Boater Navigational Aids (Nantucket Harbor)	$19,382	100%
	Nantucket Transient Boater Navigational Aids (Madaket Harbor)		
2007	New Bedford Transient Navigational Aids & Moorings (New Bedford Harbor)	$95,000	50%
	New Bedford Transient Dinghy Dock (New Bedford Harbor)		
2009	Scituate Marine Center Transient Access (Scituate Harbor)	$90,000	75%

Two grants were open in 2010, and are described in more detail.

New Bedford Transient Boater Access Project: The New Bedford Harbor Development Commission, as part of its long term plan to expand and improve transient boater access to the cultural, historic, and recreational resources of New Bedford Harbor, is in the process of purchasing and installing two channel markers and associated tackle; three no wake zone markers and associated tackle; 15 moorings, helical anchors, and associated tackle for boats up to 50' in length; five moorings, helical anchors, and associated tackle for boats greater than 50' in length; and three dinghy docks at a downtown location within easy walking distance of city attractions and resources. This project is expected to be fully completed in 2011.

Scituate Marine Park Transient Boater Access Project: Scituate Marine Park Transient Access Project is well on the way to increasing transient boater berthing and access to

Boston Harbor's natural, historic, and scenic attractions at a newly designed multi-use boating facility through the purchase and construction of: one aluminum ADA compliant gangway, transient dockage for 14 vessels, handicapped accessible restrooms, handicapped accessible showers, and a Maritime Boater Visitor Center (Figure 23).

The Project is part of a multi-year, multi-million dollar Marina Redevelopment Program designed to: (1) renovate and expand the municipal marina, (2) provide new docks, a pumpout station, (3) a working boatyard, (4) an ADA accessible marina and maritime center and comfort station with showers, laundry facilities, and snack machines, and (5) a maritime park walkway with decorative benches, and marsh viewing stand, and lighting throughout. The Town of Scituate has purchased a $4.3 million dollar parcel of land encompassing the boatyard, marine park, and sensitive marshland, in an effort to preserve it for use by all and to preclude commercial or private development. The park, expected to be completed in 2012, will be enjoyed by all via a waterfront promenade, a pedestrian walkway from the maritime center to a viewing platform near the marshland, and water taxi and walkways to Scituate's downtown restaurants, stores, and shops.

Figure 23. The new boater visitor center and transient boater dockage in the Town of Scituate funded by a BIG grant

Other Activities: The Boating Infrastructure Grant Coordinator is an active member of the Massachusetts Legislative Boating Caucus. The Coordinator also maintains agency membership with the States Organization for Boating Access. The Coordinator contributed substantial changes to the draft BIG Final Rule: 50 CFR Part 86; thereby preventing proposed language that would negatively affect the Massachusetts BIG Program.

The Coordinator is responsible for preparing annual financial and progress reports, preparing annual grant submissions, and working with potential applicants. Other staff contribute to this work. In 2010, technical assistance was provided to the year's Tier I applicant, the Wessagusset Yacht Club, and a potential 2011 Tier II applicant, Mariner's Port Yacht Club in Salem Harbor.

Capital Assets

Facilities

MarineFisheries maintains facilities at several coastal locations throughout the state. Headquarters are located in Boston, and the two primary field stations are located in Gloucester and New Bedford. Other facilities include the Shellfish Purification Plant in Newburyport, the Martha's Vineyard Research Station in Vineyard Haven, and a subsidiary field office and storage facility in Sandwich.

In fiscal year 2010, *MarineFisheries* spent almost $300,000 in facility planning, infrastructure maintenance, and emergency repairs. In New Bedford, final architectural and engineering designs were submitted for the build-out of a support facility to be constructed on a 3-acre parcel owned by the Division in the South Terminal Extension on Blackmer Street. The Gloucester Office added new parking, completed major renovations to the bacteriological building, and completed emergency repairs to a boiler and the roof. A 25-year old furnace was replaced at the Martha's Vineyard Research Station, along with corroded lolly columns. Winter storms and shifting currents deposited tons of beach sand at the Shellfish Purification Plant resulting in an additional 25 feet of beach being added seaward of the facility. An additional 30 feet of pipe was added to the existing outfall and engineered plans were developed for a permanent solution to the "sanding-in" problem.

Vehicles and Boats

MarineFisheries maintains a fleet of 40 vehicles and 16 boats. In 2010, almost $36,000 was spent on maintenance and repair for all stock. A total of eight old vehicles were turned in to the Office of Vehicle Management and were replaced with similar vehicles, including four pick-up trucks, two cars, one SUV, and one stocking truck. Several old outboard motors, a boat trailer, and a skiff were listed as surplus through the Operational Services Division and were removed from *MarineFisheries* inventory. One working outboard motor that was no longer needed by *MarineFisheries* was given to the Division of Conservation and Recreation.